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ELECTRICAL WORLD

MARCH 19, 1932

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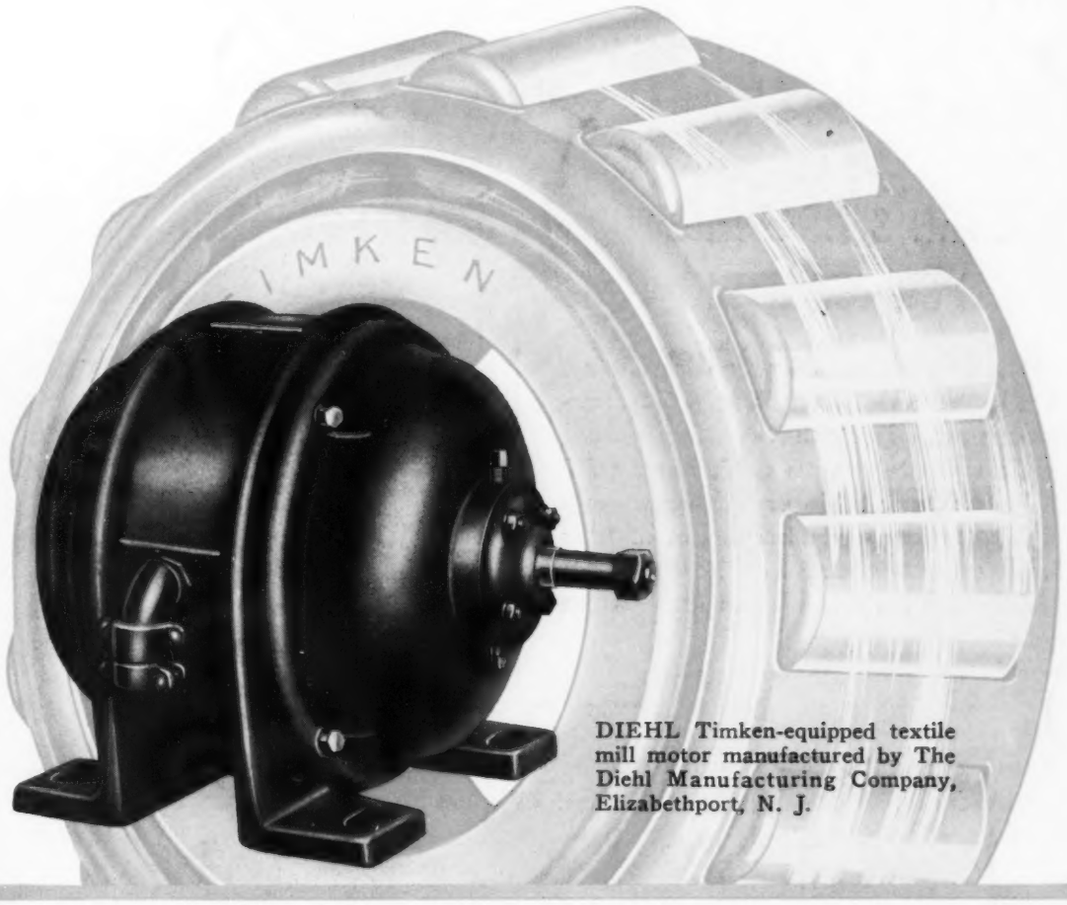

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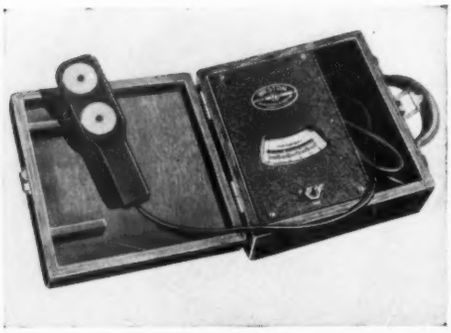

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A consolidation of Electrical World, Electrical Engineer and American Electrician

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MARCH 19, 1932

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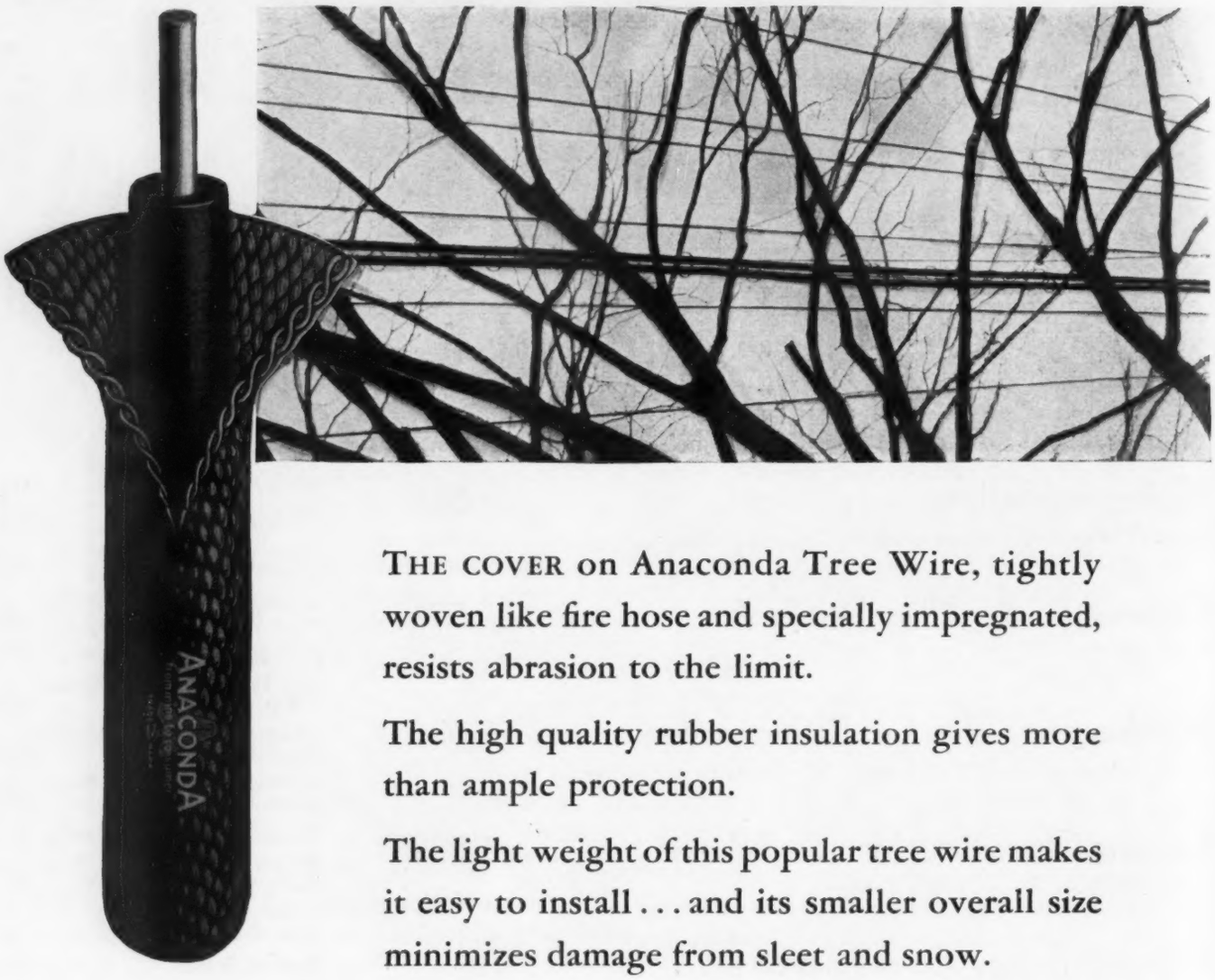

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ELECTRICAL WORLD

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for the Week Ending

March 19, 1932

More than nine-tenths of the smoke particles now found in New York City air come from relatively small fires in homes, apartment houses and small office buildings and not from large factories and power plants as is generally supposed.
E. E. FREE,
New York University

[Dr. Free so advised the illumination group, New York Section, American Institute of Electrical Engineers, last week in reporting the results of a five-year study.]

Electragists to fight 5-and-10-cent store wiring

—**Better-wiring plans adopted** by various chapters of the Associations of Electragists International. All-metal standard to be pushed as the acceptable way to secure safety, adequacy, permanence and satisfaction—*p. 520.*

—**Heating by electric induction** enters the low-intensity field. California greenhouse successfully and economically warmed may open new applications for this hitherto metallurgical melting principle—*p. 523.*

Commission defied in South Carolina

—**Rate-investigating committee** made recommendations which State Railroad Commission incorporated in an official order. This all except one utility in South Carolina refuse to follow—p. *514.*

—**Steam-station cost factors** should be analyzed on the basis of many elements. Sites and territorial conditions, compactness and simplicity of arrangement important—*p. 531.*

Weatherproof wire to be improved?

—**Improved weatherproof wire** is on the way. Research at Purdue University shows the saturant to be the most important long-life factor. Blown asphalt is best. Economies justify use—*p. 536.*

—**Life line thrown by landsmen** with the aid of a standard Coast Guard line-throwing gun. Object was to speed economical stringing of connectors across 1,000 ft.-wide canyon—*pp. 527 and 530.*

Nebraska Power in federal quiz

p. 515.

—**Buyers' and sellers' interests** should be co-ordinated, says Southern California Edison purchasing man, so that profits are realized as economies are effected. Economic chaos should not lead to lunacy, he contends—*p. 528.*

—**Changes on Insull properties** show a greater degree of local autonomy to be extending to managers in the Middle West system. Follows precedent set by other large organizations—*p. 518.*

State Legislatures Do Little to Alarm Electrical Industry

New York utility bills fail.
Massachusetts and Mississippi defeat anti-merchandising bills.
Kentucky drops tax bill.
Virginia wants rate inquiry.

ALTHOUGH the political attention of the light and power industry is now centered at Washington, with the interpretation of the proposed sales tax on energy and the likelihood of its becoming law both still matters of dispute, the outcome of the political movements previously noted at various state capitals demands further record as the nine legislatures which met in regular session and those others called in special assembly for revenue-raising purposes one by one adjourn. Thus far, however, there has been little to excite the special opposition of light and power companies, save perhaps in South Carolina, where, as reported below, a somewhat tense situation arose as the result of the report of the legislative investigating committee appointed last year.

Bay State anti-selling bills die

Both of the bills to prohibit utilities from merchandising appliances which were before the Massachusetts Legislature have been defeated. The Metropolitan Electrical League of Boston says that the opposition to the bills was "tremendous" and represented plumbers, furniture, hardware and electrical dealers, department stores, manufacturers and associated industries as well as the electric and gas utilities against which the bills were aimed. The league adds: "The strength of the opposition to passage of the bills is a tribute to electrical utility merchandising in Massachusetts. Co-operative merchandising activities were a strong factor in the decision." Petitions for legislation to regulate public utility holding companies were adversely reported to the Legislature by the committee on power and light.

Mississippi follows suit

The Mississippi Legislature has defeated a bill which would have prohibited public utilities from selling merchandise in the state. The Senate voted the measure down by 27 to 9. The measure was aimed at the gas and electric companies and was supported by a few of the smaller merchants, plumbers and electrical dealers. Measures to increase state taxation on light and power companies failed.

No new utility laws in New York

Adjournment of the New York Legislature took place on March 11 without the passage of any of the laws affecting the regulation of public utilities which were introduced by the Democratic minority and backed by Governor Roosevelt (ELECTRICAL WORLD, March 5, page 427, and March 12, page 471). The measure to permit municipalities to establish power districts to buy and distribute St. Lawrence energy also went down to defeat.

Tax bills fail in Kentucky

Bills for taxing electric power and light and natural gas have been killed in the Kentucky Legislature. The power bill would have called for a state tax of 0.25 cent per kilowatt-hour of energy sold in the state or exported. The desire of the promoters of the bill was to impose the tax on the utilities in such a way that it could not be passed on to the consumer.

The utility companies of Kentucky have refrained from either supporting or opposing the bill to set up a state commission for their regulation described last week (page 471). A utility official is quoted as saying: "Any stand we might take would be contested. Naturally we would prefer that there be no commission or interference. With a legal salary limit of $5,000 in Kentucky, the right sort of engineers probably would not be employed. Again, the commission would probably be composed of men who know nothing of utility problems."

Rate investigation for Virginia

A joint resolution asking the State Corporation Commission to investigate the rates of public service corporations, in view of the reduced costs of labor and materials, introduced last week, was unanimously adopted by the Virginia House and sent to the Senate.

A bill broadening the scope of the State Corporation Commission's control over water-power development in Virginia, which has a bearing on the contemplated plants as Goshen Pass and Radford, has passed the Virginia House by a vote of 79 to 5. Under the measure the commission receives control over the construction of dams across any stream in Virginia, navigable or non-navigable, for the generation of hydro-electric energy.

▼

South Carolina Companies Defy Commission's Order

Several power companies in South Carolina have indicated that they do not intend to submit to the South Carolina Railroad Commission schedules of rates based upon the findings of the power rate investigating committee. Soon after the report of that committee,

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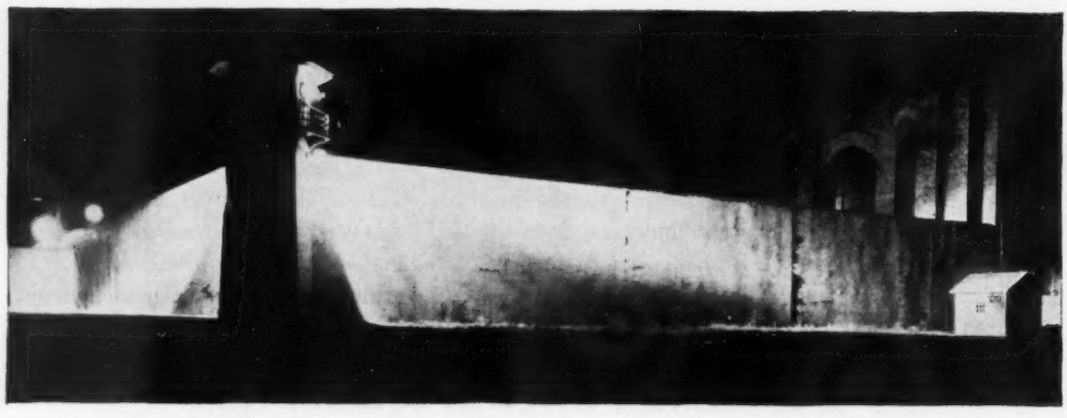

HIGH-INTENSITY FLOODLIGHTING WITHOUT GLARE AIDS JAIL GUARDS

Directional floodlighting installed by General Electric engineers at the Great Meadow State Prison, Comstock, N. Y., projects a continuous path of light along both sides of the wall and thus reveals to the guards any person approaching from within or without. Floodlamps are mounted beneath the balcony at each guard tower, visors shielding the guards from glare. Wall sections lighted by a single beam vary in length from 250 ft. to 400 ft.

created by the General Assembly of South Carolina, was filed last January the Railroad Commission adopted an order, directed to the Duke Power, Southern Public Utilities, Broad River Power, South Carolina Power and Carolina Power & Light companies, the five large light and power utilities operating in the state, to submit within 20 days schedules of rates based upon the findings of the investigating committee. All of these companies except the South Carolina Power have refused to comply with the order.

The Duke Power Company and the Southern Public Utilities Company, allied concerns, with headquarters in Charlotte, N. C., put their refusal on the ground that the commission was "proceeding on a basis that is erroneous in method and result." The Broad River Power Company, controlled by the Associated Gas & Electric Company, says: "This company does not acquiesce in the report of the special power rate investigating committee. It is, therefore, obvious that we cannot accede to the request of the commission." The Carolina Power & Light Company, a National Power & Light subsidiary, with headquarters at Raleigh, N. C., asserts that it has been advised by counsel that the order was "unreasonable, unlawful, void and beyond the jurisdiction of the commission." It charges that it has not had a hearing and that the commission cannot supervise and regulate rates and service until the utility concerned has a hearing and it is proved that existing rates are improper.

The South Carolina Power Company, on the other hand, promised to file a revised schedule of rates on or before the second day of April, which the Railroad Commission accepted as an intention to comply with its order. The South Carolina Power is controlled by the Commonwealth & Southern Corporation, New York.

In the meanwhile changes in the bill to regulate the states utility companies are under consideration by the judiciary committee of the state House of Representatives, to which committee the proposed measure was returned. The Attorney-General, who criticised the bill, asked several amendments. "Our only interest is to get a regulatory bill passed at this session that will aid the people in getting cheaper rates and provide stricter supervision," said the investigators.

As the bill stands at this writing sections giving the Railroad Commission control over municipally owned power plants have been stricken out. One amendment provides that no power company shall be allowed to abandon service except for non-payment of bills unless it secures an order from the State Supreme Court, after a hearing before the Railroad Commission, whose powers are to be enlarged.

Europe's Recovery Chief Bullish Factor

WHILE commodity prices turned down sharply with stocks following the death of Kreuger, Swedish industrialist, the occurrence has no business significance here. It threatens to arrest European improvement, but only temporarily.

Europe's progress toward recovery cannot but bolster faltering confidence here. Central banks all over Europe lowered their discount rates recently, indicating improved conditions and confidence. German election results are decidedly stabilizing.

While tangible evidence of recovery here is all but totally lacking statistically, foundations now being laid for easier and more liquid credit are gradually strengthening basic conditions. Bank failures declined sharply to only eleven last week. A larger-than-normal circulation decrease last week strongly suggests a further release of hoarded money. First-quarter industrial reports will inevitably reflect further drastic reductions in business, but this factor is being discounted well in advance.

Nebraska Profits Great, Commission Examiners Say

"Write-up" of more than 100 per cent—Bond & Share makes $1,232,000 plus fees—Top return to American Power 93.6 per cent.

Turning temporarily from Insull to Electric Bond & Share properties, the Federal Trade Commission listened on March 9, 10 and 11 to figures presented by Examiners Adams, Meleen and Lundvall which indicated that the Nebraska Power Company, organized in 1917 and 1918 by the Electric Bond & Share Company and turned over to the allied American Power & Light Company, had been a highly profitable investment. The Nebraska utility and its subsidiary, the Citizens' Power & Light Company, serve Omaha, its Iowa neighbor Council Bluffs, across the Missouri, and more than 40 smaller communities.

Testimony by Mr. Adams brought out that the ledger value of the fixed capital account of the predecessor company (Omaha Electric Light & Power) on May 31, 1917, amounted to $357 per kilowatt of its 18,000 kw. of installed capacity and that one day later, on June 1, 1917, the Nebraska Power Company carried identically the same properties on its books at $750 per kilowatt, or more than double. This "write-up," the examiner declared, represented no addition either of property or cash to the operating company. Subsequent additions of equipment charged to capital account, however, brought the inflation per kilowatt down, by 1930, to $72.

Mr. Adams also testified that the company paid fees and commissions to the Electric Bond & Share from 1918 to 1930, inclusive, totaling $1,431,524. Of this amount, $849,176 was for supervision fees and the remainder for special services, financing and construction charges.

A tabulation presented by Mr. Meleen showed that Electric Bond & Share realized a profit of $1,232,000 on the stock of the original operating company. The excess of the Nebraska Power Company's total capitalization over the value of securities issued by the American Power & Light was $5,311,171 over and above the profit realized by Bond & Share. In addition to the profit realized by these two companies, the examiner said, the "write-up" also paid the net premium and expenses incurred by Bond & Share in acquiring the stock of the Omaha Electric Light & Power Company.

Mr. Lundvall testified that, based on the subsidiary's earnings, the rate of return to American Power on its investment in the common stock equity of Nebraska Power ranged from about 47 per cent in 1921 to 67 per cent in 1924. In every year since 1921, he testified, and through 1928, the rate of return exceeded 55 per cent.

Based on the amounts actually received by American Power from the Nebraska Power Company, the return from its investment in securities of the subsidiary, reckoned on the actual cost of these securities, reached as high as 95 per cent on the common stock equity and 93 per cent on the total investment. The return on the total investment, on this basis, grew from 12.8 per cent in 1922 to 93.6 per cent in 1927, while the return on common stock equity rose from 24.2 per cent to 95.7 per cent, according to the examiner.

The commission adjourned until March 16, when the affairs of the New England Public Service Company of Augusta, Me., a subsidiary of the Middle West Utilities Company, were to be examined. W. S. Wyman will testify.

▼

New York Would Impound Edison Company Receipts

New York City, through Corporation Counsel Hilly, has moved to impound all payments made by consumers to the four Edison companies for electric energy, pending the Public Service Commission's decision on the city's application for further rate reductions. Mr. Hilly is represented as basing his new move on a belief that the promise of the Edison companies to bring about through the new rates put into effect last summer a reduction of $5,500,000 a year "has not worked out as a reduction to the mass of smaller consumers."

A.I.E.E. Men at Milwaukee Report Notable Advances

Weatherproof wire the braids of which will not hang in graceful festoons a few years after installation, a single-phase motor for railway and possibly for other large-power uses and the utilization of the proximity heating effect in better controlled methods of electric welding were offered at the Great Lakes District meeting of the A.I.E.E. in Milwaukee this week as more than merely vague promises of development. The first two of these matters are treated at some length elsewhere in this issue (pages 523 and 536).

C. F. Harding in his presentation of the weatherproof-wire paper stated that the companies included in the Utilities Research Commission, at whose instance the wire study was undertaken, were arranging for the manufacture of a carload of the improved wire so that it could be tried out in actual service. The improved insulation makes use of "blown" asphalt as the braid saturant. Some who took part in the discussion of this paper appeared to question the necessity of the development, but it was held that price competition had brought a definite lowering of quality.

The discussion of the paper by O. K. Marti on the new type of single-phase motor made possible by utilizing the controllability of the mercury-arc rectifier by means of variably charged grids was concerned less with the practicability of the proposed motor than with the operation of the associated rectifier. The possibilities of flashbacks and other rectifier troubles as obstacles to the development were discussed, but the disposition appeared to be to let the idea be worked out.

Proximity effect used for heating purposes—described by the author of the paper, E. A. Bennett, as the application of phenomena previously considered as only troublesome—may open up new fields for the industrial application of electric heat. Certain features of control and application appear to indicate large possibilities of development.

A group of three papers concerning the Waukegan station of the Public Service Company of Northern Illinois—one, by J. L. Hecht, discussing the growth of the station in relation to the development of the art of power generation; the second, by E. R. Williams, describing its electrical design features, and the third, by R. B. Williamson, detailing the design and construction of the 115,000-kw. unit lately installed—were received with interest. In the discussion Mr. Hecht stated that the recent oil fire at Waukegan due to the failure of a potential transformer demonstrated the merit of metal-clad switchgear in that if it had occurred in a station of usual construction the damage would probably have been much greater because the fire would have affected structure and equipment above the transformer which are absent in the metal-clad installation.

Characteristics of insulators in transmission-line and station design in relation to other system parts received exhaustive treatment in papers by W. L. Lloyd, by J. J. Torok and C. G. Archibald, by H. A. Frey and K. A. Hawley and by A. O. Austin. Atmospheric conditions, including smoke and gases as well as natural weather variations, were shown by Mr. Lloyd in their specific effects on insulator flashover. Messrs. Torok and Archibald presented data from impulse and normal frequency tests on suspension-insulator strings relative to unit-shell diameter and unit spacing. The Frey and Hawley paper dealt with the normal frequency arc-over values of insulators as affected by size and humidity.

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New Muscle Shoals Bill and Old One in Congress

House subcommittee reports the new measure — Norris' perennial bill makes its re-entry in Senate

A special subcommittee of the military affairs committee of the House of Representatives reported on March 10 to the full committee a new proposal for the disposition of Muscle Shoals which in part followed the lines favored by the Muscle Shoals Commission appointed last year by President Hoover and the Governors of Alabama and Tennessee. The subcommittee's measure would provide for leasing on liberal terms facilities for the manufacture of nitrates, but the government would control the power switchboard.

A commission of three would be appointed by the President and confirmed by the Senate for the purpose of conducting leasing negotiations. Unless a lease could be consummated within eighteen months, the government would take the plant over. The lessee would agree to run the plant for 50 years. Profits to the lessee would be limited to 8 per cent. In the case of any excess power priority would be given first to states, counties or municipalities and then, following open bidding, to non-profit-making agricultural agencies.

Cove Creek Dam, by the terms of the bill, would be constructed by the government when the lease is effected, and if there were no lease signed within eighteen months, the dam would be constructed on certification by the proposed commission as to the need for more power.

A day or two before the House subcommittee reported this bill, the agricultural committee of the Senate once more trotted out in the Upper House the Norris government-ownership bill, twice passed and twice vetoed, once by President Coolidge and once by President Hoover. This bill would set up a ten-million-dollar corporation to build transmission lines and sell power, with preference accorded to cities, counties and towns. Extension of the generating plant and construction of the Cove Creek Dam are provided for.

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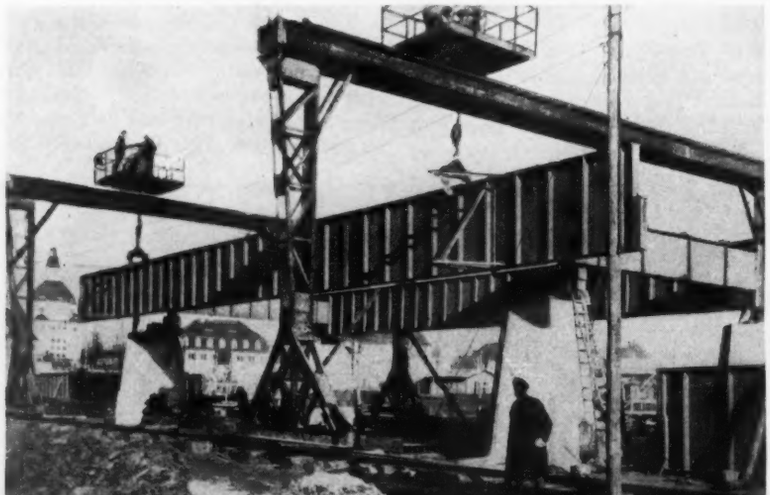
DRESDEN BUILDS LONG ARC-WELDED BRIDGE



—Keystone View Co.

A bridge 1,036 ft. long and 30 ft. wide, completely welded by electricity, will soon span the Ostra flood channel at Dresden, Germany. The welded girders are shown as they are laid on double concrete pillars.

Allege Racketeering by Contractors and Unions

That electrical contractors in New York City composing the Electrical Contractors' Association work hand in hand with the International Brotherhood of Electrical Workers to harass competitors and to parcel out the most profitable contracts among themselves, under an agreement whereby the employers pay to the Union Co-operative Insurance Association of Washington, D. C., 20 cents a work-hour for every man employed—or about $1,000,000 a year—is charged in a suit brought by fifteen members of the New York local union against officers of that local and Howell L. Broach, president of the International Brotherhood. Mr. Broach, the complainants say, is also president of the insurance association. The suit is now before the State Supreme Court.

These accusations are similar to those made in St. Louis nearly a year ago which resulted in the Missouri Supreme Court ordering the dissolution of three electrical associations (ELECTRICAL WORLD, April 25, 1931, page 750, and May 9, page 841).

▼

St. Lawrence Board Wants Washington to "Clarify"

A résumé of the proceedings of the New York State Power Authority up to date is contained in the first regular official report of that body, made last week to the Governor and Legislature. The Power Authority told about its negotiations over St. Lawrence development with the State Department at Washington, already reported in the ELECTRICAL WORLD, and of informal negotiations with the Ontario Hydro-Electric Power Commission, expressing satisfaction with the progress so far made in both these directions, but saying that clarification is needed of a statement from the Secretary of State reading:

"Whatever the rights of the State of New York may be in respect to any electric power developed by the navigation project on the river along the international boundary, utilization of that electric power must in the end depend upon the authority and permission of the federal government."

After the receipt of the communication containing this statement the Power Authority asked Secretary Stimson whether the federal government, in its negotiations with Canada and in its recommendations to Congress, would recognize the "sole ownership" of the state in the waters of the St. Lawrence within the state boundaries, as well as the right of the state to develop and dispose of the hydro-electric power derived, subject only to the state's paying its share in the cost of the joint project and in developing the power according to plans in conformity with the federal plans and insuring protection to navigation.

"No direct reply to the question has been received by the Power Authority from the Secretary of State," the report says. "In a measure, however, the rights upon which the Power Authority has insisted have received recognition."

▼

Engineering Practice Is Examined at Boston

Current engineering practice in transmission and distribution was critically scrutinized in the interest of greater economy in investment and operation recently at Boston in a two days' gathering of the Engineering Section of the New England Division, N.E.L.A. Recent developments in network applications at Boston, Medford and Pittsfield, Mass., were reviewed in papers by A. H. Sweetnam, A. O. Summerville and J. P. McKearin. L. L. Elden, Boston Edison company, presented an analytical study of network economics in which the importance of more penetrating investigation of costs was stressed in comparing the possibilities of radial distribution by regulated feeders from unattended substations with network installations.

Major H. S. Bennion, engineering director N.E.L.A., depicted the need of viewing house wiring as an engineering problem, pointing out the advantages of layouts with the equivalent of bus construction to facilitate use of appliances and increased lighting. He condemned the widespread use of flexible cord in place of permanent wiring. Mr. Elden discussed proposals of general-purpose motor manufacturers looking toward a relaxation of existing rules limiting starting currents and requiring stated power-factor limitations and opposed letting down the bars to admit cheaper designs. Clarence Birdseye described his quick-freezing process, which depends on electric service. E. W. Dillard outlined progress in the co-ordination of insulation on the 115-kv. and 230-kv. lines of the New England Power Association. Many other topics were considered in committee sessions.

▼

Federal Power Commission to Extend Its Activities

As the result of additions to its staff approved by the House appropriations committee, the Federal Power Commission during the next fiscal year intends to devote its attention to carrying out the sections of the water-power act authorizing the regulation of the issuance of securities by licensees in states where there is no similar regulation. The House appropriations committee in reporting out the independent offices appropriation bill has made the explanation that the 1933 program for the Power Commission contemplates the addition of two appointees—one attorney and one assistant chief accountant at $3,800 each.

Officials of the Power Commission called attention to the fact that only half of the states have provided regulatory services having jurisdiction over hydro-electric companies operating on licenses issued by the federal government. Frequently the licensees of the commission experience embarrassment in seeking to bring their securities under a legal status sufficient to meet the requirements of savings-bank laws. To meet this situation it was urged that there should be no more delay in permitting the commission to exercise its supervisory powers over securities. The Power Commission will act only in cases where there is no state supervision.

Coming Meetings

National Electric Light Association — Group committee meetings, Commercial National Section, Edgewater Beach Hotel, Chicago, March 22-24. A. J. Marshall, 420 Lexington Ave., New York.

Maryland Utilities Association — Lord Baltimore Hotel, Baltimore, April 8. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

New England Division, N.E.L.A. — Safety conference, Boston, April 8. Miss O. A. Bursiel, 20 Providence St., Boston.

Great Lakes Division, N.E.L.A.—Engineering Section, Sherman Hotel, Chicago, April 13 and 14. R. G. Walter, Wisconsin Power & Light Co., Madison, Wis.

Northwest Electric Light and Power Association — Engineering Section, Heathman Hotel, Portland, April 13-15; H. H. Schoolfield, Pacific Power & Light Company, Portland. Accounting Section, Davenport Hotel, Spokane, Wash., April 18-19; W. F. Miller, Washington Water Power Company, Spokane.

Electrochemical Society — Lord Baltimore Hotel, Baltimore, April 21-23. C. G. Fink, Columbia University, New York.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 26 and 27. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

American Welding Society—New York, April 27-29. M. Kelly, 29 West 39th St., New York.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 28-30. Jesse Blythe, 103 West High St., Jefferson City, Mo.

American Institute of Electrical Engineers—District meeting, Providence, May 4-7; summer convention, Cleveland, June 20-24. Acting secretary, 33 West 39th St., New York.

Middle West Division, N.E.L.A. — Muehlbach Hotel, Kansas City, Mo., May 18-20. Thorne Browne, 1527 Sharp Bldg., Lincoln, Neb.

East Central Division, N.E.L.A.—Commodore Perry Hotel, Toledo, Ohio, May 24-27. D. L. Gaskill, 603 Broadway, Greenville, Ohio.

National Electric Light Association — Atlantic City, N. J., June 6-10. A. J. Marshall, 420 Lexington Ave., New York.

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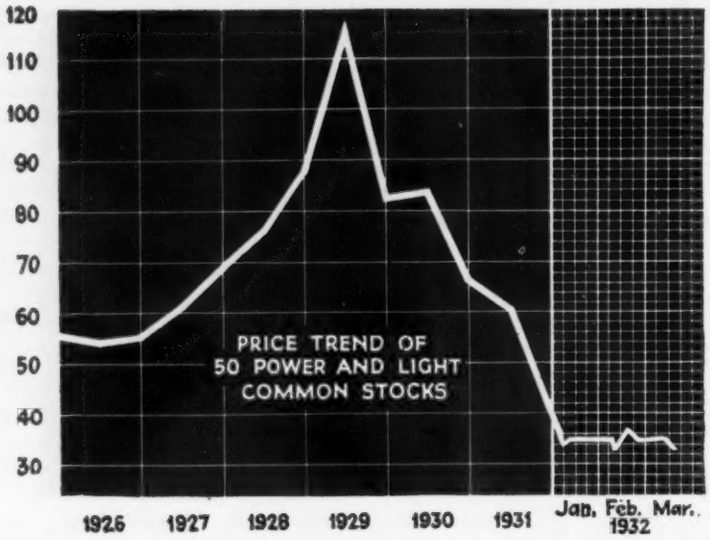
Stocks Approach Previous Lows



Utility common stocks approach their early February low levels, due largely to further recession in the Insull stocks and in the Bond & Share group. Several individual stocks entered new low ground. Bonds turned soft again this week after a prolonged period of rising prices.

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Boston Edison Earnings $15.63 per Share in 1931

In the face of the depression, the per share earnings of the Edison Electric Illuminating Company of Boston were $15.63 in 1931, a gain of 19 cents over the previous year. Gross operating revenues also gained almost $200,000; operating expenses were reduced about $150,000 and taxes increased $270,000. The rate reduction ordered by the Public Utilities Department of Massachusetts in September, 1930, was in effect all last year and the industrial use of electricity in the company's territory, while highly diversified, was handicapped by the depression to no small extent. The depreciation allowance of the company for 1931 was $100,000 greater than in 1930. Domestic business was vigorously pushed and electric refrigeration, both household and commercial, gained remarkably. Off-peak electric water heating was established in the spring and has been growing steadily if slowly. Dividends paid were $7,274,000, or $13.60 per share. The total energy generated and purchased was 1,073,421,850 kw.-hr., against 1,103,000,659 kw.-hr. in 1930. Coal cost $4.637 per ton, against $6.767 in 1930.

Gross operating revenue for 1931 was $30,815,429, against $30,617,180 in 1930, and operating expenses were $12,788,132 and $12,937,115, respectively. The outstanding common stock was 534,875 shares, of $100 par value per share.

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Greater Local Autonomy in Middle West System

A greater degree of local autonomy is being extended to managers in the Middle West Utilities System. This seems to be in accord with the decentralization trend evidenced throughout a great part of the utility industry. It also allows Samuel Insull to devote most of his efforts to the financial problems of the Middle West Utilities Company and other leading companies in which he is interested. Under the present change, he resigns as chairman of some of the many intermediary holding companies and operating companies in the system.

This trend toward decentralization of control has been evidenced in the utility industry for some time. It may be assumed to be a characteristic of the

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Current Earnings Reports of Electric Light and Power Companies

OPERATING COMPANIES

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
Arkansas Power & Light (Year ended December 31)					
Gross earnings	$8,165,898	$8,736,484	— 7.0	51	55
Net earnings	3,975,323	3,970,722	0.0	..	..
Central Illinois Public Service (Year ended December 31)					
Gross earnings	14,920,686	15,645,177	— 4.6	61	63
Net earnings	5,712,499	5,845,443	— 2.3	..	..
Commonwealth Edison (Year ended December 31)					
Gross earnings	80,551,164	84,004,438	— 4.1	60	61
Net earnings	31,567,036	32,647,724	— 3.3	..	..
Connecticut Electric Service (Year ended December 31)					
Gross earnings	17,020,925	17,938,219	— 5.1	59	61
Net earnings	6,948,502	7,016,518	— 1.0	..	..
Connecticut Light & Power (Year ended December 31)					
Gross earnings	14,122,788	14,779,312	— 4.4	57	60
Net earnings	6,032,833	6,008,640	0.4	..	..
Jersey Central Power & Light (Year ended December 31)					
Gross earnings	11,895,202	9,249,034	22.4	55	59
Net earnings	5,332,968	3,829,658	39.2	..	..
Utah Light & Traction (Year ended December 31)					
Gross earnings	1,306,062	1,536,010	—15.0	83	77
Net earnings	230,135	348,683	—34.0	..	..
Utah Power & Light (Year ended December 31)					
Gross earnings	10,643,615	11,233,433	— 5.0	48	45
Net earnings	5,599,660	6,157,169	— 9.0	..	..
	1932	1931		1932	1931
Kansas City Power & Light (Year ended January 31)					
Gross earnings	14,709,305	14,822,094	— 0.8	44	45
Net earnings	8,279,685	8,180,107	1.2	..	..

OPERATING COMPANIES

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Nevada-California Electric (Year ended January 31)					
Gross earnings	$5,622,563	$5,717,390	— 1.6	49	48
Net earnings	2,894,118	2,994,114	— 3.3	..	..
Southern California Edison (Year ended January 31)					
Gross earnings	40,455,232	41,183,719	— 2.0	34	32
Net earnings	26,849,835	28,198,580	— 5.0	..	..

HOLDING COMPANIES

	1931	1930		Operating Ratio 1931	Operating Ratio 1930
American Power & Light & Subs. (Year ended December 31)					
Gross earnings	$83,213,280	$87,087,661	— 4.5	47	48
Net earnings	43,685,658	45,502,455	— 4.0	..	..
American Water Works & Electric & Subs. (Year ended December 31)					
Gross earnings	49,931,729	54,066,879	— 7.6	50	51
Net earnings	24,803,362	26,369,698	— 5.9	..	..
Associated Gas & Electric & Subs. (Year ended December 31)					
Gross earnings	105,253,143	104,138,451	1.0	54	54
Net earnings	49,035,519	47,785,329	3.0	..	..
Electric Power & Light & Subs. (Year ended December 31)					
Gross earnings	80,045,149	75,047,899	6.6	49	50
Net earnings	41,167,755	37,565,237	9.6	..	..
National Power & Light & Subs. (Year ended December 31)					
Gross earnings	77,425,919	80,375,509	— 3.7	53	55
Net earnings	36,339,320	36,345,851	— 0.0	..	..
Standard Gas & Electric & Subs. (Year ended December 31)					
Gross earnings	159,070,293	172,406,693	— 7.7	53	56
Net earnings	74,088,922	76,095,943	— 2.8	..	..

present era, just as concentration of capital characterized the period of expansion of the late twenties. It has been thought by many that this process of centralization had created unfavorable public relations rather than promoting better public relations, especially in those cases in which the real management was far from the center of operation of the utility. Large organizations such as Standard Gas & Electric, Public Service Corporation of New Jersey and Stone & Webster, Inc., have already introduced a large degree of local autonomy in their systems.

Some of the recent directorial changes were: Samuel Insull, Jr., was elected chairman of the Public Service Company of Indiana, to succeed his father, Samuel Insull, and Robert M. Feustel, formerly vice-chairman, was elected president, succeeding E. Van Arsdel, who was elected a vice-president. William A. Sauer was elected a vice-president, Edwin J. Booth was elected assistant to the president and B. R. Nightingale assistant secretary. Previously William A. Sauer and Bernard P. Shearon succeeded Samuel Insull and Samuel Insull, Jr., as directors of the West Ohio Gas Company. Similar changes have taken place in other companies of the Midland United group, and elsewhere.

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Boston Edison May Issue More Shares

The Edison Electric Illuminating Company of Boston plans to issue more common stock in the near future. The company has notes totaling $70,000,000 coming due next fall. The management's present plan is to issue one new share for each three now outstanding. There are now 534,675 shares and the proposed increase would add 178,225 shares. A special meeting will be held March 30 to decide the issue. If the stockholders approve the plan the company will apply to the Department of Public Utilities for authority to issue stock. The price will be determined later.

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Niagara-Hudson Will Spend $19,000,000 in 1932

To improve and extend its facilities for serving customers, the Niagara Hudson Power System will spend $19,301,000 during 1932. Electric distribution lines are the largest single item in the budget with an appropriation of $7,625,000. The improvements provide for a continuance of a very active rural expansion program which will add a considerable number of new customers to the line. Transmission line additions will require $5,706,000.

American & Foreign Power Omits Preferred Dividends

Directors of the American & Foreign Power Company, Inc., have taken no action on the declaration of the quarterly dividends on the $7 and $6 preferred stocks of the company, ordinarily payable April 1.

At the office of the Electric Bond & Share Company it was stated that the principal reasons for the omission of the dividends at this time were the unusually disturbed economic and financial conditions throughout the world and the difficulties being encountered in converting into United States dollars the moneys of several of the countries in which principal operations are being carried on by subsidiaries.

Exchange control commissions or similar bodies which are restricting the total amount of remittances which can be made at this time are in operation in six of the twelve countries in which subsidiaries operate, including Argentina, Brazil and Chile, where operations are extensive.

The hostilities in Shanghai have brought about lessened operations of the mills and other industries supplied by the Shanghai Power Company, a subsidiary of American & Foreign Power Company, Inc. This makes uncertain for the time being the earnings which may be derived from this source. The Shanghai Power Company has suffered only minor property damage as a result of these hostilities.

The consolidated earnings of American & Foreign Power Company, Inc., for the twelve months ended December 31, 1931 (including preliminary cabled figures for December), using the average quoted New York cable rates for each month for calculation of the local earnings into United States dollars, show that the dividends on the $7 and $6 preferred stocks for the twelve months were earned more than two and a half times. In view of the difficulty in bringing the foreign earnings into the United States in dollars, however, the directors decided to take no action on the dividends.

Dividends on the $7 and $6 preferred stocks have been paid regularly since the issuance of the stocks. The dividends are cumulative.

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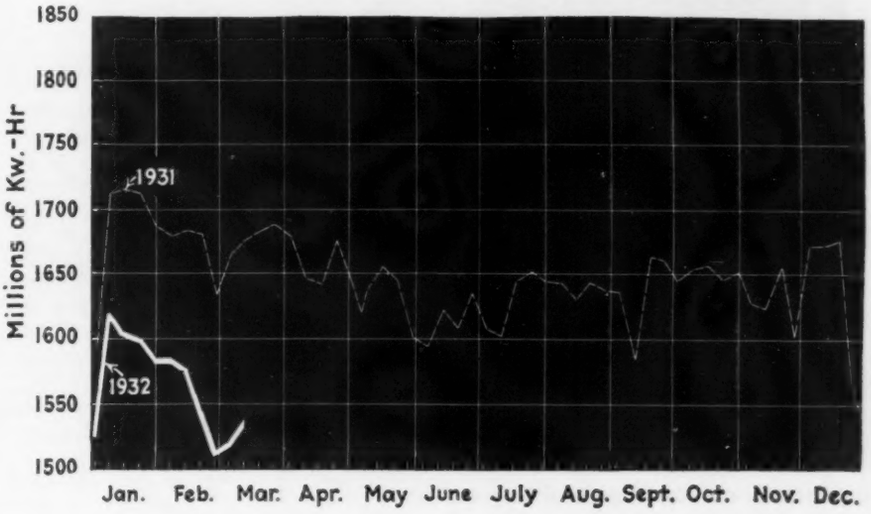
Week's Output Again Mounts



RISING slightly for the second time from the minimum in the latter part of February, figures on the weekly energy output of electric light and power plants show changes similar to those of last year, but remain consistently lower. For the week ended March 12 the National Electric Light Association estimates a total that is down 8.2 per cent; in the four preceding weeks the deficiency compared with the corresponding weeks of 1931 was, successively, 6.2, 8.0, 7.4 and 8.7 per cent.

A relative improvement appears in the Central industrial area, down 11.1 per cent, against 13.1 per cent a week ago, and particularly in the Chicago district, 4.5 per cent under 1931, against 8.9 per cent.

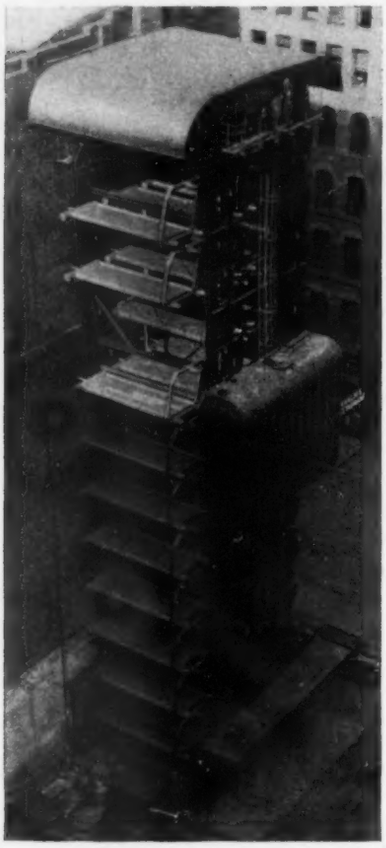
Weekly Output, Millions of Kw.-Hr.

	1932	1931	1930	1929
March 12	1,538	1,676	1,735	1,687
March 5	1,520	1,664	1,750	1,703
February 27	1,512	1,633	1,744	1,707
February 20	1,545	1,680	1,746	1,699
February 13	1,579	1,684	1,770	1,718

Per Cent Change from 1931

Region	Week Ended March 12	March 5	Feb. 27
Atlantic seaboard	— 3.1	— 3.9	— 2.6
New England alone	— 3.9	— 3.2	— 2.5
Central industrial	—11.1	—13.1	—11.7
Chicago district	— 4.5	— 8.9	— 8.3
Pacific coast	—12.1	—10.5	— 9.2

ELECTRICITY MAKES VERTICAL EASY AS HORIZONTAL



On March 5 (page 436) the control unit of the 105-ft.-high Westinghouse vertical garage in Chicago's "Loop" was illustrated in the *Electrical World*. Above is shown the 48-car garage itself. Cradles, one for each car, are supported between two endless electrically driven chains which pass over sprocket wheels at the top and bottom.

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Westinghouse Loss Heavy, but Cash Position Strong

While the inactivity of general business is reflected in the annual statement of the Westinghouse Electric & Manufacturing Company for 1931, the company is shown to be in a strong position. Sales billed by the company and its manufacturing subsidiaries for the year total $115,393,082, against $180,283,579 for 1930 and $216,364,588 for 1929. Orders received by the company and its manufacturing subsidiaries during the year totaled $128,014,820, which is a decrease of 24 per cent from the 1930 total and 46 per cent from that of 1929.

The value of unfilled orders on the books of the company at the end of December was $40,024,390, against $40,208,181 at the end of the previous year. Operations for the year resulted in a loss of $3,655,659, which compares with the net income of $11,881,705 for 1930. This loss, the company states, was incurred largely in the first and last quarters of the year—in the first quarter because the reduction of expenses inaugurated had not had time to make its full impression and in the last quarter principally because of a sharp contraction in the volume of incoming business.

Provision for depreciation and obsolescence in buildings and equipment aggregated $5,173,914 for the year.

The balance sheet as of December 31 shows cash and United States and other marketable securities totaling $32,148,727, approximately the same total as for December 31, 1930. Current assets amounted to $100,522,486 and current liabilities $7,368,011, indicating a net working capital of $93,154,475 and the ratio of 13.6 to 1. Inventories of finished products and raw materials were valued on the basis of cost or loss with provision for obsolete and slow-moving stock. Inventories as of December 31 were $44,180,683, against $49,096,162 at the end of 1930.

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Electragists for All-Metal Wiring

"ARE you ready to turn over your wiring business to the 'five and ten?'" is a question that the Association of Electragists International addresses to contractors in broadcasting a resolution which has been adopted by a large number of Electragist chapters and several state conventions of Electragists during the past few weeks. The resolution appears to be the opening gun of a long-smoldering fight against 5-and-10-cent store wiring. The aim is to establish the all-metal standard in opposition to cheap short cuts for the connecting of new appliance and light loads. L. W. Davis, general manager of the association, points out that the resolution looks toward standardization and simplification of wiring and elimination of waste through simplified wiring practice on the all-metal basis. Wherever this program has had a test over a considerable period of time the resulting economies through elimination of needless varieties and types of wiring methods have given to the public higher standards of wiring at a lower commensurate cost than has ever resulted from the efforts to develop cheaper and inferior wiring materials, declares Mr. Davis.

The resolution for eliminating waste through simplified wiring practice is:

Whereas the Bureau of Standards, U. S. Department of Commerce, in urging the adoption of simplified practice by industries, has pointed out that the elimination of needless variety in types of everyday commodities means a more intelligent utilization of our resources, more efficient production with lower costs, greater productivity, lower maintenance expense, greater protection against unscrupulous traders, and with a path that is then clear for the agencies of standardization to improve the grades, quality and performance of the types that are retained in a simplified line; and

Whereas during the past 40 years the electrical industry has accumulated fifteen different wiring methods permitted in the code, each of which has several hundreds, and in some cases thousands, of types and dimensions of fittings and parts constituting the system, and today there are knocking at the door of the electrical committee several additional wiring systems further to increase the complexities; and

Whereas steadily, little by little, the industry standards for safety to life and property have been pushed aside by interests seeking commercial advantages through attempting to cheapen wiring by substituting non-metallic wiring materials or concentric and bare-neutral wiring methods for the sturdy, mechanically protected, properly insulated and grounded all-metal wiring systems; and

Whereas the four basic types of all metal wiring systems—standard rigid metal conduit, flexible metallic conduit, armored bushed cable and metal raceways—are ample to meet all needs of diversities in building conditions and occupancies, embodying greatest safety to life and property, with greatest flexibility and economy of installation, and permanency and efficiency of operation, resulting in greater public acceptance and satisfaction; therefore, be it

RESOLVED: That this association goes on record as favoring: (1) A state-wide and nation-wide program for standardization and simplification of wiring practice through the adoption of the all-metal types of wiring systems—standard rigid metal conduit, flexible metallic conduit, armored bushed cable, surface metal raceways, underfloor metal raceways and metal wireways, with all conductors insulated. (2) The enlistment of all contractors, inspectors, utility companies, architects, electrical workers and local regulatory bodies in securing the enactment of proper local electrical installation ordinances for safeguarding life and property, restricting approved types of wiring methods and materials to the all-metal types, with all conductors insulated, and with all conduits, armored cable, raceways, wireways, boxes and fittings having metallic-coated surfaces, assuring continuous bonding and grounding.

The announcement broadcasting the accompanying resolution quotes excerpts from an address by H. S. Bennion, director of engineering, N.E.L.A., with the statement "Do you want this? If not, it is up to you." Among the excerpts to which attention is called with warning are the following:

Nevertheless, were it not for the free use of lengths of lamp cord and the use of 5-and-10-cent store fittings, the sales of electric current by the electric light and

power industry would be far below their present levels . . .

In view of these circumstances it is apparent how important is the development of wiring methods and materials which will permit the early addition of more adequate wiring to the average man's house, at costs far below those entailed in the installation with present wiring methods and materials. . . .

It seems to me that in looking for a solution of the rewiring problem in the home of the average man, we would do well to direct our attention first toward improving the rewiring method he is already using and to which I have already referred. This is an exposed or surface method of wiring which consists of lamp cord tacked along the baseboards, along picture molding, around windows or door frames, or in the corners of walls. . . .

If surface wiring is to be satisfactory to millions of householders, it must not only be approximately as cheap as lamp cord and call for simple fittings, while presenting a neat appearance, but some of the circuits must have large capacity. The use of concentric or bare neutral wire will be important to this wiring scheme.

When householders everywhere can buy in convenient and attractive form concentric or bare neutral, or fully insulated wiring and fittings, at about the price of lamp cord and its fittings, some sixteen million of them will provide themselves with an ample number of outlets and with adequate branch circuit capacity, and the rewiring problem will disappear as an important consideration.

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General Electric Spreads Available Work

Although the guarantee of employment or equivalent pay for apparatus works' employees of the General Electric Company will terminate on April 30, in accordance with the plan announced October 1, 1931, the emergency clause of the unemployment insurance plan will continue and every effort will be made to spread the available work as far as possible and to grant relief to those employees for whom little or no work is available, President Gerard Swope has declared.

"Employees after May 1 not earning 50 per cent of normal pay, up to $15 per week, will be eligible for such relief as authorized by the board of administrators after reviewing the needs in each case," President Swope explained. This money will be taken from funds collected by the 1 per cent deduction from pay of all employees receiving 50 per cent or more of regular pay and the company's contribution, which will continue in force after May 1.

Since the unemployment emergency was first declared on December 1, 1930, payments have been made at various times to 19,673 different employees. Payments from this fund to February 28, 1932, totaled $1,724,000. One-half of this money was contributed by the employees earning 50 per cent or more of their normal wages and one-half by the General Electric Company.

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New Sales Plan for Westinghouse Dealers

A new plan based on the theory that a combination of electrical household appliances can be sold by a single effort on installment-payment terms has been announced by the merchandising department of the Westinghouse Electric & Manufacturing Company. It is said that merchandising departments of central stations and department stores had an advantage over other retailers since they were in position to give buyers the opportunity to secure several products through one type of contract on the installment-payment basis.

Under the new plan purchasers may buy any group of Westinghouse appliances they may select under a single contract and complete payment by an initial and subsequent installments, based on the total purchase price. Westinghouse wholesalers will provide authorized dealers with all necessary co-operation in sales planning and will help to capitalize the new plan of building larger sales through combination selling. It is understood that responsible dealers who are unable to secure local aid for financing on the installment basis may discount their paper through the Commercial Investment Trust, Inc.

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Belting Standards Changed

The American Leather Belting Association announces that for the greater protection of the consumers of leather belting this commodity will henceforth be sold by specifications of thickness instead of weight, thereby discarding the old weight terminology of "ounces per square foot," which may be varied by the mere addition of weighting materials to the leather and does not necessarily always represent a differential in transmission values. The decision to do this was reached after the association had canvassed all manufacturers of belting throughout the country. The movement can, it is said, be considered as having the indorsement of the entire industry.

This is an interesting and progressive move, in the opinion of the association, for the purpose of establishing higher standards for a product that has been sold by weight for many years. Inasmuch as leather belting prices are based on thickness, the simplicity and common sense of this change has met with the instant approval of both manufacturers and users of leather belting. It simplifies and makes comparatively easy the checking of each piece of belting to see if the average thickness is as ordered.

Major New Construction This Week

TRANSFORMERS, power feeder lines, substation equipment, electric machine drives, motors, controls, switchboard and instruments, conveyors and miscellaneous electrical equipment costing over $50,000 will be installed in proposed milling plant to be built by Anozira Mining & Milling Company, Los Angeles, Calif., at copper properties near Salome, Ariz.

Wilmette, Ill., asks bids until April 5 for electrical and other equipment for municipal water works, including generator unit, transformers, switchboard, control apparatus, switching equipment, motor-driven pumping units, etc. Estimated cost $600,000.

Motor drives, controls, panelboards and instruments, conveying apparatus and accessories, costing close to $18,000, will be installed in three additions to Eureka cotton mill, Chester, S. C.

Electric equipment to cost over $40,000 is to be installed in the new buildings of Hershey Industrial School, Hershey, Pa.,—motors, controls, panelboards, lighting fixtures, stage lighting equipment, etc.

Niagara-Hudson Power Corporation, Syracuse, N. Y., has authorized a fund of $5,706,000 for extensions in steel-tower and wood-pole transmission lines in different parts of the state during remainder of year, including rebuilding of number of lines for increased voltage.

Bids to be asked by Piqua, Ohio, on electric generating plant, including turbo-generator, complete boiler-room equipment, switchboard and instruments, motors and accessories. Fund of $810,000 available.

Bids asked until March 25 by division of purchases and sales, Department of Commerce, Washington, D. C., for lighting equipment for Fort Worth-Atlanta Airways, including 30 electric rotating beacons. Total distance, 480 miles. (Proposal 24,150.)

Two Iowa municipalities are arranging funds for purchase of electrical equipment for power plants: Sumner, Iowa, is to hold a special election March 24 for approval of bond issue of $95,000 for such purpose; Villisca, Iowa, has called special election March 28 for a bond issue of $150,000.

New York Metal Prices

The recent announcement that copper producers had at last come to an understanding both in respect to curtailment and the marketing problem in the export field hardly caused a ripple in the market.

	Mar. 2, 1932 Cents per Pound	March 9, 193 Cents per Pound
Copper, electrolytic	6-6¼	6
Lead, Am. S. & R price	3.25	3.15
Antimony	6¼	6.20
Nickel, ingot	35.00	35.00
Zinc, spots	3.15	3.15
Tin, Straits	22.30	21.75
Aluminum, 99 per cent.	23.30	23.30

House Would Make Power, Senate Would Buy It

After having been informed by the Potomac Electric Power Company that commercial rates for electric power in Washington are less than the cost of production by small independent units, the Senate appropriations committee has stricken from the Interior Department appropriation bill an authorization of $300,000 for the construction of a heat, light and power plant at Howard University in Washington. The House allowed the appropriation for the heating and power plant on the claim made by government engineers that this would be cheaper than to purchase energy from the power company. These opposing opinions will probably have to be adjusted in conference.

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Waukesha Asks Lower Rates

Through its city attorney Waukesha, Wis., is petitioning the Public Service Commission of the state for a joint investigation of the city's gas and electric rates, which the petition says are discriminatory against the small consumer and far in excess of what other cities in the state are paying. The petition stresses reduced cost of fuel and labor. It is served by the Wisconsin Gas & Electric Company of Racine.

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Bridge River Plant Tunnel Ready

The concrete lining of the 2½-mile tunnel destined to carry the waters of Bridge River through the mountains of British Columbia to Seton Lake has been completed as the first part of the British Columbia Electric Railway Company's major power development to serve Vancouver and the lower mainland of the province. Work on this project has now ceased and no definite plans have yet been made for continuation. Initial development was for the generation of 54,000 hp. at a cost of about $14,000,000. The ultimate capacity of the Bridge River project is 600,000 hp.

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Construction in Ottawa District

The Ottawa Valley Power Company, which, with the Ontario Hydro-Electric Commission, is jointly developing the Chats Falls power site on the Ottawa River, now has installed and in operation four units, with a rated capacity of 112,000 hp. This is half of the ultimate development. Work on the other units is proceeding steadily. The Gatineau Power Company, in the same region, is constructing additional substation and transmission-line facilities to provide for expanding power requirements in the Ottawa and Hull districts. The rating of the company's Val Tetreau substation is being increased from 40,000 hp. to 80,000 hp. through the installation of three additional 10,000-kva. outdoor transformers and additional switching equipment.

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NEW LIGHT KEEPS OUT BOGUS OLD MASTERS

—*Wide World Photos*

A. P. Laurie, scientific detective of trickery in painting, finds the ultraviolet lamp of great service in his work for the British Royal Academy.

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Tacoma Sticks to Ten-Year Contract

Tacoma (Wash.) voters at the March 8 election defeated, by 8,231 to 5,171, a charter amendment which would have enabled the Public Utilities Department to contract with industries for the sale of power and water for 25 years instead of ten. Supporters of the amendment declared it necessary to enable Tacoma to bid for new industries on an equality with Seattle and Portland, but it was held to be a dangerous measure which would allow a city council hostile to municipal ownership to tie the city up for 25 years to a losing contract.

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Tacoma's New Steam Plant Ready

Long delayed because of the necessity of replacing defective concrete in the condenser intake, the Tacoma municipal steam-electric plant No. 2, on the Hylebos Waterway, containing a 25,000-kw. turbo-generator, is now ready for its initial tests. It has cost $2,000,000.

Power Taxes in Canada

As an alternative to the proposed income tax on power plants in Canada, privately owned companies have suggested a sales tax on power sales. This, it is claimed, could be so arranged that public and private systems would be taxed alike and thus bring about an equalization. During 1929, the last year for which complete returns are available, the gross income of all privately owned power companies in Canada was $66,000,000 and that of publicly owned systems $51,000,000.

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Farmville (Va.) Plant Taken Over

After four years of negotiation, ownership of the Farmville (Va.) municipal electric light and power plant has been formally transferred to the Virginia Public Service Company. First payment was $159,400, and the remainder of the $500,000 purchase price will be paid at stated intervals in a manner equivalent to having the company assume the entire bonded indebtedness of the town. The utility will build a transmission line to its Bremo Bluff generating plant, 40 miles away, within three years.

▼

Bronx Borough Rates Approved

The Public Service Commission of New York has approved a new schedule, effective March 15, for electricity supplied by the Bronx Gas & Electric Company to that part of the Borough of Bronx, city of New York, north and east of Bronx River. The new schedule is designed to accomplish uniformity in rates and service classifications in the Bronx. The changes result for the most part to the advantage of consumers.

▼

Tax Dispute in Indianapolis Warm

Controversy between the Indiana state tax board and the county assessors of Indianapolis over the 1931 valuation of the new Harding Street plant of the Indianapolis Power & Light Company is vigorous. The plant first was assessed by the township assessor at $8,000,000 and was reduced by the county board to $5,000,000 and then cut to $1,500,000 by the state board. The county assessor, holding the state board's action to be illegal, says that a suit will be filed.

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Rate Investigations in Indiana

Public utility rates at South Bend, Ind., including electric, gas and telephone utilities, are to become the subject of an exhaustive investigation by the City Council. The Public Service Commission would rather have one of its force

make the required surveys, but it is asserted that the Council will insist on an engineer of its own selection. South Bend, which in this matter is falling into line with a score of other Indiana cities, is served by the Indiana & Michigan Electric Company. The administration of Michigan City has begun the appraisal of the property of the Northern Indiana Public Service Company in that city, appointing its own engineer after learning that the commission could not make an investigation for at least six months.

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Induction Heating Now Applied to Greenhouses

At an initial cost approximating one-half of that required for an equivalent steam or hot-water heating system a small greenhouse near Pasadena, Calif., is now warmed on the induction principle. This form of energy application, familiar in the high-temperature and industrial fields, is said to function with notable success in greenhouse service. Perhaps it may be made to serve other low-temperature purposes.

In this installation No. 12 asbestos-covered monel wire in ½-in. "Steeltube" is used. One circuit consisting of 158 ft. of wire and conduit is connected to the 220-volt supply, taking 5.9 kw., or an energy dissipation of 37.5 watts per lineal foot. At this rating the temperature of the surface of the conduit may reach 240 deg. F. when the surrounding air temperature is 75 deg. F. Energy consumption is averaging about 0.2 watt per square foot of glass area per degree difference in temperature between outside and inside air.

The possibilities in applying this form of electric heating to other low-intensity heat-release problems are interesting, and the continued success of the Pasadena experiment may affect many home, commercial and office applications of electricity for space heating.

▼

Reversing Mill Driven by Synchronous Motor

What is said to be the first installation of a synchronous motor to a continuous reversing rolling-mill drive has recently been completed at the Chicago plant of the Dallas Brass & Copper Company. The rolling job here is the breaking down of copper cakes into strip. The motor in this installation reverses in a maximum of five seconds, and while the installation is subject to certain limitations, the suitability of a synchronous drive for some relatively small metal rolling mills where constant speed is satisfactory and where a reversing period of four or five seconds does not handicap production has been demonstrated.

For such small reversing mills requiring motors of 1,000 hp. or less this type of drive, as developed by the Electric Machinery Manufacturing Company, is said to offer considerable savings in both first and operating costs. The higher efficiency as compared with induction or direct-current motor drives, of course, explains this in part.

Commutatorless Motors for Railroad Electrification

Mercury-arc rectifiers, which have so greatly influenced railroad electrification because of their ability to convert a.-c. to d.-c. power at high voltages with a high degree of economy and reliability, may give another impetus to railroad electrification.

It is now possible, announced O. K. Marti, engineer in charge of rectifiers and railway equipment for Allis-Chalmers, at the A.I.E.E. meeting in Milwaukee this week, by the use of a commercial mercury-arc rectifier equipped with special grid control to build a commutatorless motor which does not require the elaborate and costly switching, reversing and control equipment used at present. Such a motor could be used with current of any frequency so that 60-cycle power circuits could be used to supply power to railroads without costly frequency-changer and 25-cycle transformer equipment.

The principle involved is essentially that of any "inverted" rectifier which converts direct current into alternating current. The commutatorless motor has series characteristics, and regenerative braking of a locomotive equipped with such motors is practicable.

Brown, Boveri, Ltd., of Switzerland is at present building a single-phase, 50-cycle, 15,000-volt locomotive which has no commutators, tap switches, starting resistances or reversing switches in the motor circuits. All such equipment is replaced by a high-voltage mercury-arc rectifier with control grids.

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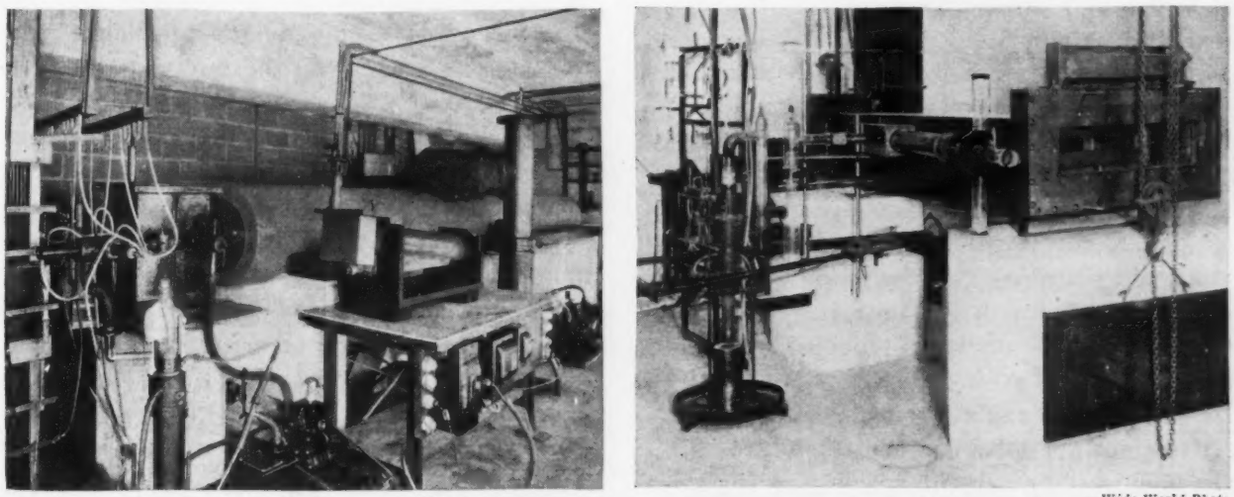
M.I.T. RESEARCH MEN AID IN PENETRATING ULTRA-VIOLET BARRIERS



—Wide World Photo

Advanced research in the ultra-violet end of the spectrum will be futhered by two new spectrographs at the Massachusetts Institute of Technology's new laboratory in Cambridge. On the left is a 21-ft. apparatus designed by Prof. G. R. Harrison for the study of arc discharges in vacuo, a conventional size of spectroscope being shown on the table in front. Motor-driven and mercury pumps exhaust the air to a ratio of less than one molecule in ten million. On the right is a spectrograph of the vacuum type for the investigation of electrical discharges through gases, designed by President Karl T. Compton of the Institute.

EDITORIALS

L.W.W.MORROW
Editor

Air conditioning—the outlook

INTEREST in air conditioning is rapidly sweeping through the land and taking root in the variety of industries that see in it an opportunity to participate in a great new popular market. Refrigerated theaters gave the public its first taste of the benefits of air conditioning. Then came the main floor of Macy's department store in New York, the dining room in the Hotel Stevens in Chicago and a few other pioneer installations. Then the Baltimore & Ohio Railroad put on its refrigerated train from New York to Washington, and soon air-conditioning devices were being featured by other roads on their crack trains. The idea is taking hold. Two dozen or more manufacturers have developed commercial equipment, and now all eyes are turned to the home as the great market. Some are beginning to say that here is the new industry that, like the automobile and radio, is going to lift the country out of the hard times and carry it forward into a new prosperity.

Be that as it may, the outlook is growing in scope and interest week by week. Manufacturers of refrigerating and ventilating equipment see a broadening field ahead. To chemical manufacturers it offers a new market for refrigerating and dehumidifying chemicals. Ice manufacturers recognize the possibilities for their product. Heating and plumbing engineers and contractors are directly concerned. Manufacturers, wholesalers and retailers of other types of household equipment hope that it will bring a chance to utilize idle factory capacity and broaden marketing operations. Power companies and gas utilities have a whole new field opening up for sales of both merchandise and service, as have water companies also.

There will be a gradual evolution. Industrial applications of air conditioning will be developed to give comfort to the worker and to assist innumerable processes that need high or low humidity. The home market will be the battleground, however. There all these forces in competition will contend to sell both individual units for single rooms and built-in systems for the entire dwelling. And the part that the power companies are to play in this new drama of the marketplace should be planned now.

As a first step, air conditioning in the utility's own salesrooms and offices is obviously vital—with a demonstration home for this summer. For the electrical industry's share in the great coming market will depend no little on prompt pioneering by the power companies.

"Write-downs" will lead to better security markets

IN WRITING down its investments and proposing to reduce its capitalization the Electric Bond & Share Company took the first conspicuous step by any unit in the ranks of the electrical industry toward self-help in improving the virtual deadlock that now exists in the market for new security issues. Niagara-Hudson directors have recommended a similar action. Much has been said —some of it in a childish mood of petulant ill humor and some of it in exceedingly bad faith—about the ability or lack of ability of American corporations to float security issues at this time. The simple matter of fact is that no investor, much less a banker, is going to pour capital into corporate securities whose assets, whether property or investments, have been so badly impaired by the fall in either construction reproduction costs or security market values, or in both, as have those of the great majority of companies.

Deflation has reduced values of all kinds. Per-

haps it has gone further than will ultimately prove to be desirable; perhaps it will go further yet; perhaps a degree of recovery is just ahead. In any event the roaring days of 1929 appear far away indeed, and should such days return, advances in the engineering art have brought down and will bring down still further the costs of new projects even if construction indexes resume their former levels.

The essence of the matter is that today currency, banks, commodities and real estate have been deflated, but most corporate enterprises and virtually all utilities have steadfastly refused to read the handwriting on the wall. The only way to restore the confidence of investors is once again to make their equities and the property values behind securities represent present-day figures. There will be, it may safely be assumed, many "write-downs" of today's balance-sheet values before investors' dollars are lured into new security issues.

Basic changes in manufacturing

IT HAS been a dictum of mass production that proper economics called for a very large factory, and manufacturers have therefore striven to concentrate production in a mammoth plant. Today this conception has become erroneous. The establishment of factories in each market area has distinct competitive advantages for the owners in transportation costs, time for deliveries, adaptation of product to local conditions and in the asset of buyers' encouragement of a local industry. In addition, it has been found that the efficient and low-cost factory is relatively small. Essentially it consists of a foreman and the number of men and machines he can work with intimately and continually. The further management is removed from the factory production line, the larger the overhead, the greater the inertia against change, the more the waste in production and the less the quality of the organization as a production entity.

What does this mean? In the electrical industry it means that the single-plant manufacturer supplying the national market would do well to check his situation and his ability to meet future competition. He can decentralize now or face disaster later. The small manufacturer also has his problem. He can compete to better advantage with the large manufacturer in his local market area, but he is at a disadvantage in the national market unless he practices selective marketing and selling. He also must decentralize and select market areas wherein he can compete. In addition, the depression has taught all manufacturers that the capital used for a plant and its equipment should be written down rapidly and that the real assets of a business lie only in the continual sale of its products or services—that is, in the immediate earnings.

Allow latitude for industrial power contracts

THE spur given to utility regulation in the last year or two has accentuated the spread between the static aspects of a legal administrative code and the dynamic aspect of a moving enterprise. Contracts between utilities and also between utilities and industrial customers seem to hamper the free play of regulative machinery; therefore the disposition to frown upon them is growing. This is unfortunate and foretells trouble if it assumes sizable proportions.

Safeguarding of investment entailed by major ties demands the security afforded by a contractual guarantee. The utility can afford to take a chance as to the permanence of the individual residence customer, whereas it cannot do so with a load that calls for outlays running into thousands of dollars. And the smaller the margin of power cost saving, such as may arise in arrangements for interchange of steam and power with industrial plants, the more essential that the contract period be extended. There is always the coal clause available to satisfy the fear of the commission that inflexibility hampers its prerogatives in fixing rates without discrimination.

This one instance only serves to show that commissions, in their zeal to demonstrate the efficacy and adequacy of regulation, are prone to view electric service as a monopoly rendering an indispensable necessity. Electricity is assuredly a necessity, but the monopoly aspects are fading fast as the industry, in enlarging its scope and usefulness, encounters more and more competition with oil and gas as power sources and also finds an increasing reticence by customers to part with their dollars. Regulation will have to be economically tolerant rather than legally rigid if

it is to keep so abreast of the rapidly changing complexion of electric service as to insure the best rates and service for the years immediately ahead as well as for today.

New power houses should not be mausoleums

IN THE rapid and experimental development of power plants that has characterized the last few years the designers generally have made the serious mistake of considering each plant as something too permanent. It is symptomatic that many such plants were designated by the name of some prominent utility man or prominent engineer, as if they were bronze statues which would stand to remind future generations that these men were once leaders and pioneers in an important industry. And yet a power house, particularly a steam plant, becomes a pile of junk in a very few years—such has been the record of steam-plant engineering.

The light and power industry even now is suffering from having on its hands too many plants that were originally built for permanency but which the hand of time has made obsolete. There are expensive, monumental buildings that cannot very well be torn down and into which it is difficult to fit new equipment. Foundations, piping, switching and other equipment have been provided for future units, and when the original future has become the present it is found that all these provisions do not meet the new requirements. The industry would have been better off if the past had provided nothing for the future. An entirely new viewpoint should enter into the mind of the designer of plants. He must learn that power-plant engineering is not something permanent, something dead, something equivalent to a monument, but something alive and continually growing, something that is always temporary and never finished.

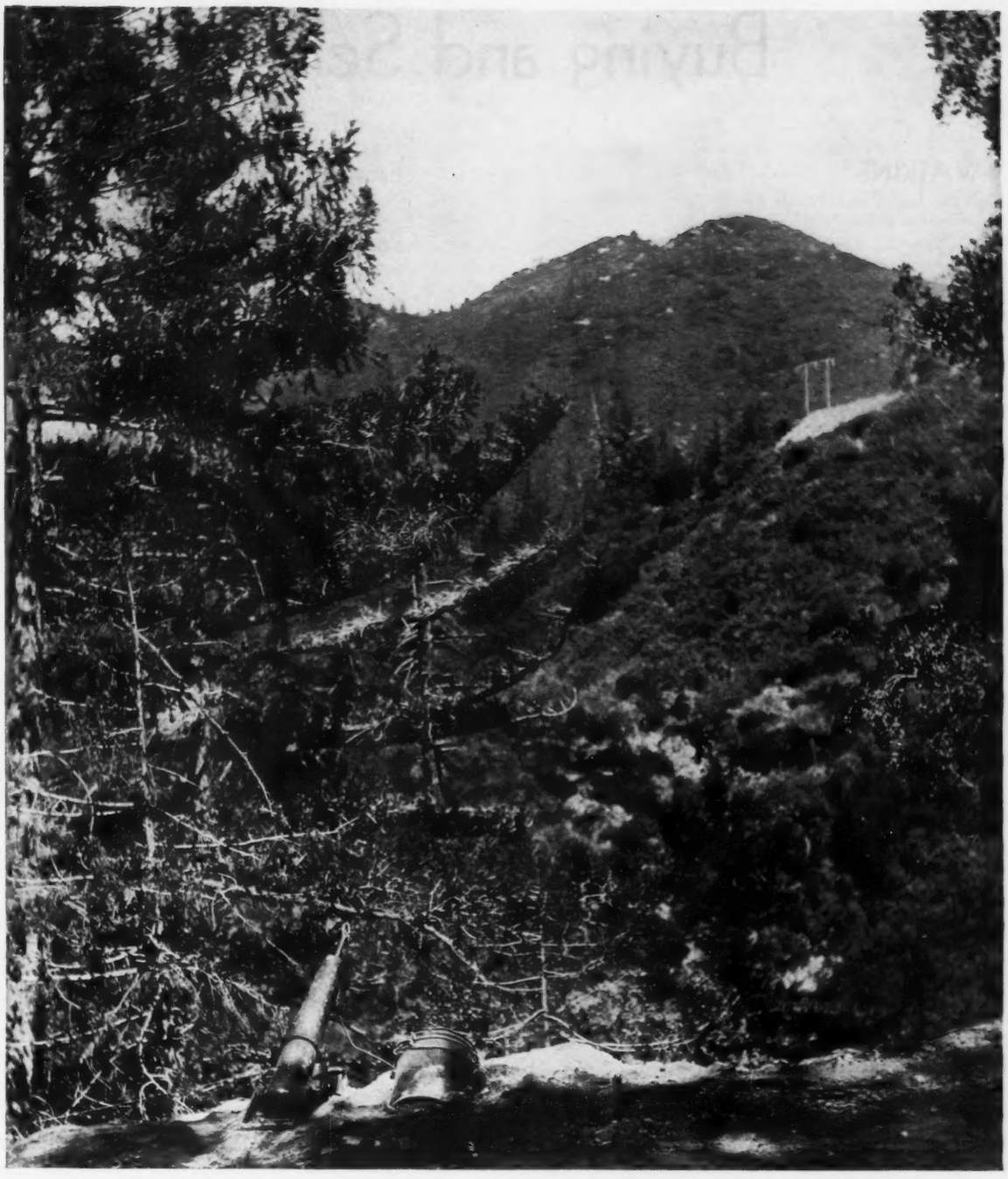
It is entirely feasible to design new plants with this point in view. In fact, it is more feasible and more logical than it was to consider a power house as monumentally permanent. Nothing at all should be provided for the future, because we know now that nothing can be correctly provided for the future. Whatever is built now should be a complete plant, ready to be torn down when it becomes obsolete. Every new extension should be a complete unit. The problem of connecting up with the old will not be more difficult than it is now; in fact, it will be much easier. Buildings, if any, should be of a temporary nature. A cheap, light building can be made to look just as well as a permanent one, because it is not the expensive stone work or steel work that makes a building appear beautiful or ugly, but the ideas that the architect may have or lack. The most important thing to remember is that steam-plant design will not and should not become permanent for a long time to come. It will continue to improve in simplicity, economy and efficiency.

Light used plentifully will protect homes from intruders

MANY advantageous practices are not widely adopted by the general public until some extraordinarily significant event has impressed the personal benefits of the practice upon individuals. One practice that falls in this category is the use of all-night floodlights to illuminate the surroundings of residences and protect them from marauders. The significant event which should impress the value of this practice on the public is the recent lamentable kidnapping of the Lindbergh child. But a household does not have to contain a child to make floodlighting appeal to its inmates. Women, particularly, fear any night entry of their homes regardless of the purpose of the intruder.

Why are more crimes committed at night than in the daytime? Chiefly because under the cloak of darkness an intruder sees opportunity to gain access to and escape from a building without detection. Provide a wide band of illumination around a house, especially as regards its back and sides, and a great impediment is erected to any one who requires the concealment of bushes and trees or the shadows around windows and doors to shield his actions.

But citizens should not stop there, if street lamps are so infrequent or light so poorly distributed that the streets may shield lurking or escaping criminals. Light, and plenty of it, is the best police protection that can be provided. Police cannot guard every house or become immediately available the minute they are needed. Light can be always on guard to protect and detect. The time to act is now, while the Lindbergh case is still fresh in mind.



Ready to shoot line across canyon

The reason for shooting lines rather than stringing them in the customary way and the equipment for doing so are explained on page 530. Unfortunately, the illustration does not give a correct impression of the roughness of the country or the depth of the canyon. The tower on the near side of the canyon is 1,000 ft. from the canyon in the foreground.

The first shot was unsuccessful because the line broke. The second shot, however, landed the projectile on the edge of the clearing around the tower base. It was not desirable to overshoot the structure because of a steep cliff on the far side of the tower. With the line shot from the canyon, it was possible to pull a heavy handline over the treetops and subsequently the $\frac{5}{16}$-in. "Copperweld" cables composing the span.

Buying and Selling

By E. F. WATKINS*
Manager of Purchases and Stores,
Southern California Edison Company, Ltd.

Economic chaos should not lead to lunacy.

Profit a necessary and legitimate part of any sound business transaction.

Price controls not the answer in themselves.

THE buyer who, in a time like this, scuttles the seller's ship for an immediate price advantage may by that very act contribute toward destroying his own best source for future supply.

The seller who, in a time of flush business activity, over-reaches the bounds of legitimate price demand is by that very act destroying the faith and confidence which may hold him the support of valuable customers during lean times.

The principle involved here has nothing to do with cant or sentimentality. It is not a preachment nor a vague theory for moralists. There is nothing about the subject that suggests any "holier than thou" atmosphere. We need not raise the eyebrow, nudge our neighbor or wink across the table at a suggestion which imposes upon each of us the obligation to deal in business fairly, justly and with understanding consideration. It is just plain, good, sound business.

Current practices lowering standards of business

It must be apparent to every man, especially if his books are closed for 1931 operations, that to continue to sell on a basis which fails to cover a proper overhead burden, plus a reasonable profit, can lead only to disaster. This is all elementally true. You listen to speakers, even orate yourselves, write articles and adopt resolutions against profitless sellers and chiseling buyers, and then go right ahead yourselves gouging and chiseling with such vigor that there is hardly a man or an industry left untainted with some phase of this mania for self-destruction.

You know quite as well as I do that many of the current methods and practices are lowering standards of business conduct; extinguishing ethical considerations, and turning honorable business competition into a sanguinary, ruthless and vicious conflict. Libel, falsehood, piracy, deceit, even plain banditry, are growing into the practices of every-day dealings to an extent that is little short of appalling. And the worst part of this situation, as I observe the tendency, is the concurrent weakening of moral fiber which should impel men with purpose and determination to draw a dead-line in principle beyond which no temporizing or inducement of expediency will tempt them to step.

I am authorized to speak here as the representative of organized purchasing, of the purchasing profession, and to express to you the deep concern we feel in witnessing the drift toward chaos in the thinking processes of so many men. We, individually as well as through our national and local organizations, are trying to keep our feet on solid ground; to be guided by reason and common sense, and by doing so to lend a steadying hand.

Contrary to the statements of uninformed commentators, we have a vast amount of competent testimony to substantiate the fact that the purchasing profession as a class, under the leadership of an executive type of broad-visioned men, deplore the present conditions of trade and industry with a very clear understanding. We have plenty of occasion daily to cope with the wildest, most frantic situations that truly seem to verge on insanity. We might expect rash things to happen with illy equipped shoestring operators, forced into conversion of goods for cash to meet urgent obligations But when large national concerns go panicky with the rest, throw all discretion to the winds, and offer merchandise at material and labor cost or less in order to make a sale, the situation has become amazing. We, as buyers, are generally helpless to cope with it. We can and do express disgust and disapproval and counsel against such foolishness, but in the end the competitive conditions of trade, the practices of bidding, the insistence of the bidders, usually force us into compliance with the system.

Seller can't expect buyer to refuse low prices

We are in hot water most of the time trying to keep out of hot water. If we intimate to a supplier that his price is too low and suggest that we are not yet looking for charity, nor to be haled into court for contributing to the delinquency of a bidder, he will come running in next time with his cost sheets and want us to tell him the price he should quote. So we get nowhere along those lines.

The subject of price regulation, by whatever means may be employed, to produce uniform quotations from all bidders on a given article sends some of my confreres in the purchasing profession into convulsions. I cannot work up any convulsions on this score if the conditions of control in a given case are honestly justifiable and the price is fair. I am more likely to convulse at finding that somebody broke down along the line and gave an extra five to somebody "by mistake."

Price control or price regulation, however, contain within themselves complicated, far-reaching and dangerous elements, which in the final analysis may produce results not possible to anticipate at the time of their

**Abstract of address presented before California Chamber of Commerce, Santa Barbara.*

formation. We may divide the subject of price regulation into two classes—that type existing under the control of government and that type existing by the consent of a group but without governmental authority.

Governmental price control may be inspired by an effort to benefit basic production and industry, but it usually gets out of hand, with bad results. We are now in a position to look back upon many instances of wreckage and catastrophe which are a sad commentary on realization of the hopes and good intentions out of which they grew. I refer to such instances as the stimulation to surpluses resulting from twenty years of governmental control of coffee, seven years in rubber, ten years in silk, five years in sugar.

As to the type of price control represented by association agreements, manufacturers' resale price control, and so forth, there is much that can be said for and against such price regulation, or whatever you may wish to call it. Some of the results, however, such as pegging of copper at 18 cents for a full year, while stocks above ground were increasing and demand decreasing, illustrate the unsoundness and danger involved in such programs. The present-day condition of the copper industry is a sermon in itself on the subject of flaunting the law of supply and demand.

I find nothing to get excited about, however, in such control, for instance, as the resale price of merchant pipe by the tube mills so long as the schedule is fairly and honestly maintained.

Organized purchasing's contribution to basic sanity is being directed toward building up a strong bond of mutual interest, of friendly confidence in our relationships with the men we do business with. We take a live and active interest in their problems and their success just as we find they take in our problems and our success. This spirit of intelligent understanding is being cultivated and is growing in this nation of ours. We intend that it shall continue to grow until it extinguishes the traditional antagonisms which were assumed to exist as a natural barrier between buyer and seller. With that purpose before us it is quite clear that we can get no gratification out of any transaction with a worthy, capable, friendly supplier which will result in injury and loss to him. We are not always able to pull him out of the bog, but at least we are not going to push him in deeper. When we have risen to the capacity of vision to regard business in its broad relationships, we grow away from and lose patience with the petty practices and meanness which remain the stock in trade of many who are playing at business.

Useless to seek a Moses

I appeal most urgently to the stamina and character that I know so well among you to assert itself in no uncertain terms. Call a spade a spade, and brand it as such, so that he who runs may read. We have had our fill of tricky hypocrisy, business crooks, demagogic quackery, plain, unvarnished lying and deceit, and a full measure of various brands of damn-foolishness to muddle our brains and clog our way and we have suffered it long enough.

I urge you to cease looking for a "Moses" to lead you out of your difficulties. I urge you to cease leaning on the weak reed of governmental agencies to solve your problems. Take matters in your own hands; know the facts; face them with courage and determination; clean house right down to the cellar and burn the rubbish. Do not deceive yourselves by temporizing with principles, but know your costs and base your prices on known costs, plus proper burden, plus reasonable and legitimate profit, and sell yourselves and your goods on honest worth, dependable service and in a spirit of complete community of interest with the customer's welfare. I can assure you that the leaders in the purchasing profession today place these qualifications I have just named ahead of price in establishing permanent sources of supply. We are not happy over the confusion and irresponsibility which force us now at times to place orders where they are not earned.

Let no one of us deceive ourselves by clinging to the idea that some time, somehow, if we can hang on long enough, we will manage to get back into the old stride in the old way and everything will be rosy again. Success for the future is going to come only to those who have the intelligence to analyze now the conditions and trends of the times, to develop the facts, then to face those facts fairly and squarely and with courage and energy map out a new course.

Our job is to clean house, reduce costs down below any levels we ever dreamed were possible. This can be done, has been done and is being done, and the men who are doing it have sense enough to refuse to join the lunatics. They keep clear of sales which do not carry a profit in addition to burden. The management of such concerns will not tolerate any salesman with the price complex.

We can accomplish these ends better through organized bodies like this Chamber of Commerce and we are here now to tackle that job. The responsibility for our present disorder rests to some extent on each one of us individually. We have not failed because of ignorance of economic law so much as because of utter disregard and defiance of sound principles. We have shut our eyes to the dictates of reason and common sense and let cupidity and greed dictate our policies. What we need is courage to face facts, character to stand by sound principles, a militant personal honor in our dealings, a keener sense of individual responsibility in our human relationships. The machinery for reconstruction will grow out of this.

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Safety from Compressed Air Hazards in Underground Construction

Portable air compressor tanks are tested with water at 300 lb. per square inch once a year, according to R. L. Dodd, Milwaukee Electric Railway & Light Company, as told to the Engineering Section, Great Lakes Division, N.E.L.A. Safety valves, set to blow off at 125 lb., are tested by the compressor operators in the presence of a gang foreman every Monday morning. Compressed air at 60 to 100 lb. is used only in the tools provided. No practical joking, cleaning of clothes or blowing out of anything with compressed air is permitted. Pneumatic tools adjusted or changed must be disconnected from the hose before any work is done upon them. Dulled steels are replaced only after the air hammer is disconnected from the hose.

Shooting Power Lines Across Canyons

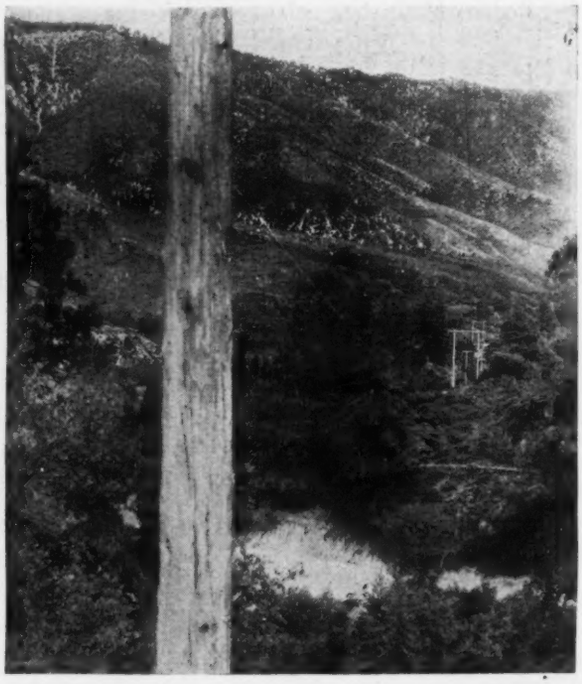
By E. Y. PORTER
Distribution Engineer
Southern Sierras Power Company, Riverside, Calif.

A Coast Guard cannon recently figured prominently in the building of an 11-kv. power line of the Southern Sierras Power Company between Camp Killkare, in the Mill Creek Canyon, and Seven Oaks Hotel, in the Santa Ana Canyon. It was used to shoot lines across the canyons and heavily wooded areas which the line traverses for pulling in the power conductors. Because of the large trees and thick undergrowth the cost of getting a line across the canyons without the use of the line-throwing gun would have been excessive. Then, too, had the usual construction practice of laying the conductors out on the ground been followed, it would have been impossible to lift the conductors into place on the towers without first clearing the right-of-way.

The cannon was a standard Coast Guard line-throwing gun such as is in common use for shooting lines out to stranded vessels. It was rented from a marine supply house in San Pedro. The projectiles were made up in the power company's shop from old cold-rolled steel shafting. They were 2⅜ in. in diameter and 15 in. long, with a ⅝-in. threaded hole in one end. In this hole was inserted an 18-in. standard eye-bolt with a few feet of ¼-in. flexible steel cable served through a guy thimble in the eye of the bolt. The total weight of a projectile was about 14 lb. To the end of the cable was fastened a $\frac{3}{16}$-in. long staple manila rope, about 1,500 ft. in length. This rope was coiled in the form of an open-lay spool to feed from the interior of the coil and was then placed in a canister beside the cannon.

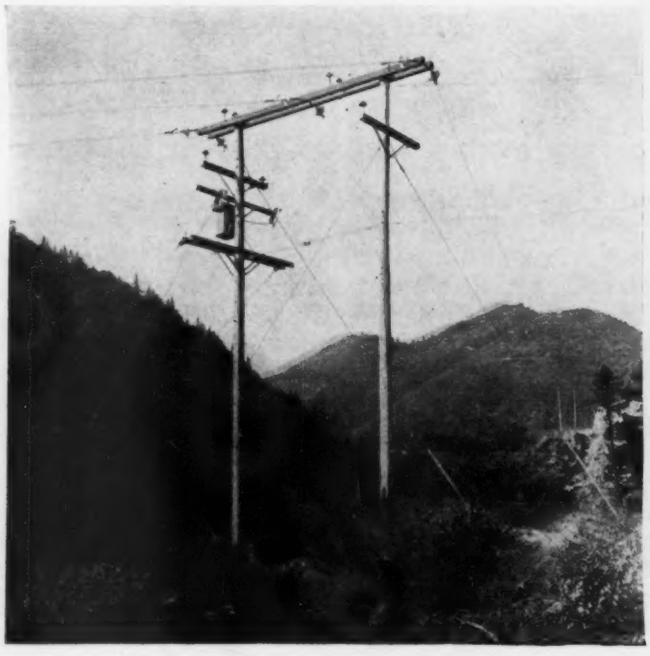
The range possible with this gun was considerably more than the longest span encountered in building the line. The angle of the gun and the quantity of powder were varied so that when the shots landed they were falling almost vertically. After a little practice the gunner was able to make shots very accurately. In fact, in a number of cases the line was actually landed on the crossarms of the towers.

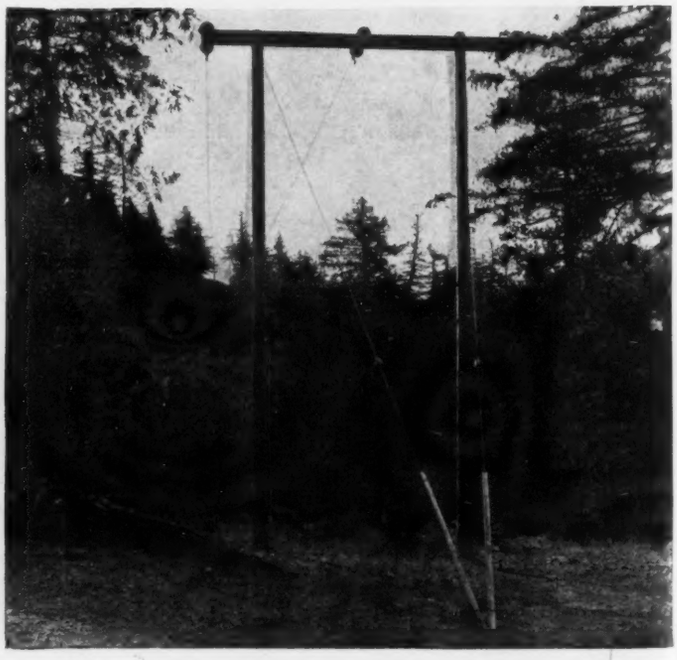
The illustration on page 527 of this issue shows the cannon in position ready to shoot a line across a canyon to a wood-pole structure 1,000 ft. away.



Some of the terrain over which lines were shot

Top—A 900-ft. span beyond Camp Angeles.
Below, left—An 875-ft. span of $\frac{3}{16}$-in. "Copperweld" strand in upper Mill Creek Canyon. This is a transposition tower.
Below, right—An 897-ft. span entering Pinezanita.





Factors Affecting Plant First Cost

By FRANK S. CLARK*
Stone & Webster Engineering Corporation, Boston, Mass.

Effect of sites and territorial conditions.
Value of compactness in design.
Simplicity of arrangement aids investment economy.

SINCE the total cost of producing electrical energy in a steam plant is made up of the sum of various expenses which are in part subject to the control of the designer, the study of governable factors in the structural cost problem is of increasing importance as the size of plants develops. In considering such problems as first cost control it would be beside the point to attempt to present arguments that a station of given capacity can or should be built for a certain total or unit cost or to try to set up any bogey operating figures. To bring this discussion within comprehensive range one may assume that the station or stations serve a territory embracing a number of load centers connected by a transmission network and that the system load is of the order of several hundred thousand kilowatts, requiring a station of large capacity, or possibly two or more of smaller size.

The number and locations of plants depend primarily on the load centers, the sizes of the loads and the availability of condensing water. Given the same load and operating conditions, there is relatively little gain in B.t.u. efficiency in a single station over that for two or more stations in which the minimum capacity of the individual units would be of the magnitude of 35,000 kw. Construction costs and operating labor, however, will be less, but the spare generating capacity required may be greater than when more than one plant serves a system. Not so much dependence need be placed on the transmission system and the losses in transmission usually will be reduced when there is more than one station.

Fuel cost is a minimum in districts where mouth-of-mine plants are possible and freight charges are eliminated. These sites, however, are relatively few, due to insufficiency of condensing water. Differentials in freight rates between sites may exist because of water delivery of fuel and for other reasons, but availability of condensing water usually dictates the choice of a site where there is any question of its sufficiency.

With a selected site, the engineer must adapt his design to the conditions imposed by the site characteristics, although these may have influenced its selection. Decisions involving thermal efficiency are subject, more or less, to engineering control through economical analyses, including the study of fuels available, methods of burning, steam pressure, temperature and heat balance. Still more subject to control are such questions as the size of units, amount of spare equipment to be provided, the size and character of building, accessibility, etc. Items affected by plant location are preparation of site and wharves and dredging where fuel is received by water. These latter items form a larger percentage of cost than they do in plants where fuel is delivered by rail. In the case of plants using liquid or gaseous fuels, which are piped to the plant, these costs are much less than in the case of water- or rail-borne fuel. Foundation costs are affected by soil conditions and an analysis of structural costs of seven different steam power stations of from

Table I—Analysis of Steam Station Costs to Determine What Percentage of Structural Cost Is Affected by Efficiency for Which Station Is Designed

Cost Expressed as a Percentage of "Structural Cost" (Overhead Costs Not Included)

Steam station No.	1	2	3	4	5	6	7
Capacity, kw	70,000	60,000	90,000	35,000	70,000	145,000	200,000
Pressure and temperature	375 Lb.-725 Deg.	350 Lb.-650 Deg.	375 Lb.-720 Deg.	450 Lb.-725 Deg.	450 Lb.-750 Deg.	375 Lb.-700 Deg.	460 Lb.-750 Deg.
Number of turbine generators	2	3	3	1	2	3	2
Number of boilers	5	8	12	3	3	15	6
Boiler plant	10.35	17.30	17.85	16.10	12.41	17.86	16.60
Draft system	3.98	3.44	5.88	2.29	4.55	4.58	6.98
Feedwater system	2.97	1.84	1.64	2.51	1.97	6.38	2.33
Total	17.30	22.58	25.37	20.90	18.93	28.82	25.91
Condensers	4.80	7.48	4.75	3.70	5.06	7.54	5.70
Turbines	8.26	11.04	10.32	10.14	10.58	11.13	12.00
Total of items affecting efficiency of station	30.36	41.10	40.44	34.74	34.57	47.49	43.61
Piping	4.73	7.05	6.71	10.28	7.38	7.58	7.84
Wharves, dredging and preparation of site	9.67	0.89	0.39	2.96	4.64	0.60	0.48
Building and foundations	22.89	23.15	16.42	21.49	22.20	21.15	9.29
Condensing water tunnels and wells	3.89	2.66	6.03	3.67	5.66	6.64	9.63
Fuel unloading and storage	4.08	0.90	....*	2.91	3.24	0.83	1.50
Fuel and ash handling	3.40	3.43	3.67	5.51	1.22	1.73	1.99
Fuel preparation	4.29	.....	.....*	.....	.....	.....	.....
Auxiliary equipment	2.69	3.28	1.46	3.48	4.45	2.63	2.53
Switchgear and wiring in station	8.48	10.18	18.00	8.20	9.58	3.93	5.13
Generators	5.52	7.36	6.88	6.76	7.06	7.42	8.00
Total structural cost	100.00	100.00	100.00	100.00	100.00	100.00	100.00

*Included in item "Fuel and Ash Handling." Note: Cost of turbine-generators assumed 60 per cent turbine, 40 per cent generator.

**Abstract of a talk before the N.E.L.A. power systems engineering committee.*

35,000 to 200,000 kw. capacity shows a variation in this item of from 2.44 to 8.57 per cent. In the former case simple spread footings only were required, without piling, and in the latter case piling was required and difficult under-water laying of concrete foundations.

Condensing water tunnels and wells depend upon plant location and in the analysis given in Table I vary from 2.66 to 9.63 per cent of the structural cost. In the former case short, simple tunnels were required and in the latter extremely long ones, which were made double to permit cleaning of mussel growths and with special provision for sand elimination.

Items whose costs are affected by the desired efficiency of the station include the heat-generating, heat-absorbing and heat-utilizing equipment and their auxiliaries; that is, the boiler plant, draft and feedwater systems, the turbine and the condensing equipment. Affected, also, to a smaller extent are the piping systems, the buildings and the fuel-handling equipment. The analysis shows that the first group forms from 30.5 to 48.0 per cent of the total structural costs. Table II is a further analysis of this group, dividing each into its component items.

The plants, the costs of which are analyzed, are all within the so-called standard pressure range of from 375 to 460 lb. pressure and operate with efficiencies ranging from 13,000 to 16,000 B.t.u. per net kilowatt-hour. The plants have all been designed and constructed since 1923.

To determine the effect which steam conditions might have on the efficiency and structural costs of a station, one of the 450 lb. pressure, 750-deg. temperature plants in the analysis was taken and comparative costs, based on preliminary data requested from the manufacturers, were figured for a similar plant operating at 200 lb. pressure (600 deg. F. temperature) and at 650 lb. pressure (825 deg. F. temperature) without reheat. The steam-generating equipment was modified as to capacity to suit the different steam demands occasioned by the changes in pressure and temperature conditions. The analysis showed practically no difference in structural cost between the 450 lb. and 200 lb. pressure stations and relatively slight increase in cost for the 650 lb. pressure station. It must be recognized, of course, that the comparison is based on using the same type of heat-generating and absorbing equipment for each of the three pressure conditions. It is probable that a study of a particular case will show that different types or arrangements of boiler plant equipment may be justified. If additional boiler units are required in the case of the 200-lb. plant, its total cost will be increased.

As the B.t.u. efficiency, based on "expectable" turbine-generator efficiencies and with reasonable allowance for boiler plant efficiency and for losses of auxiliary power, the obtainable heat rates per net kilowatt-hour figure 12,800 B.t.u. for the 450-lb. plant, 14,750 B.tu. for the 200-lb. plant and 12,000 B.t.u. for the 650-lb. plant. These figures are theoretical and based on ideal operating conditions, although one of the plants listed in Table I has operated for one year at approximately the calculated figure.

For serving any given territory, the cost of the transmission system must be considered, together with those of the steam-generating stations. Taking the latter alone, however, it may be said that investment costs will be less where the number of stations is a minimum and in which the turbine-generators and boilers are as few in number and as large in capacity as practicable without going to special types of turbine-generators which do not save in space occupied. The cost of the turbine is affected by the vacua conditions for which it is designed and, therefore, the advantages of high vacua must be considered in the light of those that are possible with the temperatures of circulating water available during the different months of the year.

Reliability of steam-generating equipment and their auxiliaries has been improved to the point where it can be said to be equal to that of the turbine-generator. It is possible, therefore, to approach the unit arrangement of plant with one boiler serving one turbine. This combination in units of large capacity will do much to decrease the cost, not only of the units themselves, but of their

Table II—Analysis of Costs of Heat Generating and Absorbing Equipment to Determine Relation of Cost of Each Item to Whole

Cost of Each Item in Account Expressed in Per Cent of Total Structural Cost

Steam station No.	1	2	3	4	5	6	7
Capacity, kw.	70,000	60,000	90,000	35,000	70,000	145,000	200,000
Pressure and temperature	375 Lb.-725 Deg.	350 Lb.-650 Deg.	375 Lb.-720 Deg.	450 Lb.-725 Deg.	450 Lb.-750 Deg.	375 Lb.-700 Deg.	460 Lb.-750 Deg
Number of turbine-generators	2	3	3	1	2	3	2
Number of boilers	5	8	12	3	3	15	6
Boiler Plant	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
Boilers and superheaters	33.5	54.4	50.8	46.5	38.0	52.5	50.2
Water walls and insulation	21.4	....	12.3	19.4	27.6	17.9	28.0
Settings	23.3	17.4	11.4	10.5	25.6	20.2	14.5
Fuel oil and gas burning equipm't	1.6	....	....	....	6.6	7.5	6.5
Pulverized fuel burning equipment	17.2	....	....	....	....	....	....
Stokers	.....	25.9	22.3	22.3	....	....	....
Soot blowers	3.0	2.3	3.2	1.4	2.2	1.9	0.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Per cent of structural cost of station	10.35	17.30	17.85	16.10	18.93	28.82	25.91
Draft System							
Stacks	10.9	33.0	7.5	20.5	5.1	7.9	5.8
Flues and uptakes	12.9	13.9	11.0	23.6	13.8	5.7	12.2
Forced draft fans	10.5	22.8	14.6	13.1	12.7	16.2	14.0
Induced draft fans	13.4	....	12.6	....	29.4	34.7	11.6
Forced draft ducts	15.1	27.2	14.6	8.6	13.5	11.1	3.0
Air preheaters	19.7	....	35.4	....	19.4	24.4	47.4
Cooling system for motors	1.4	....	....	....	....	....	....
Soot removal	0.4	....	....	2.7	....	....	....
Combustion control	15.7	3.1	4.3	31.5	6.1	....	6.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Per cent of structural cost of station	3.98	3.44	5.88	2.29	4.55	4.58	6.98
Feedwater system							
Economizers	46.4	....	....	....	....	49.3	....
Feed pumps	7.8	23.6	28.7	38.0	28.7	9.6	24.6
Evaporators	11.9	27.4	....	8.0	24.6	14.6	18.9
Heaters, tanks and drips	33.9	42.6	64.4	49.7	46.7	23.8	46.0
Feedwater regulators	....	6.4	6.9	4.3	....	2.7	10.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Per cent of structural cost of station	2.97	1.34	1.64	2.51	1.97	6.38	2.33

related equipment and of the buildings that house them. In the case of the boiler plant, this is brought out clearly in a paper delivered by the author before the American Society of Mechanical Engineers at its December meeting in 1929, the title of the paper being "The Effect of Large Boilers Operated at High Capacities on the Investment Costs of Boiler Plants."

Increasing the steam temperature affects operating economies without materially increasing construction costs. We are now at a point in this country where we can safely and economically adopt steam temperatures up to 850 deg. F., using the regenerative cycle without reheating and a corresponding pressure of 650 lb. For a given capacity, the high-pressure reheat cycle, using the heat in the flue gases, will be more costly in most cases and must be justified by special conditions of load factor and cost of fuel. As steam pressures and temperatures increase, however, some amount of steam reheating may become justified, as is done in the case of the 1,800 lb. pressure, 932 deg. F. Loeffler boiler and turbine installation at Vitkovice, in Czechoslovakia. The use of single-pass condensers is increasing, and this type, together with improved tube arrangement, will permit a reduction in the amount of condensing surface required per kilowatt of capacity.

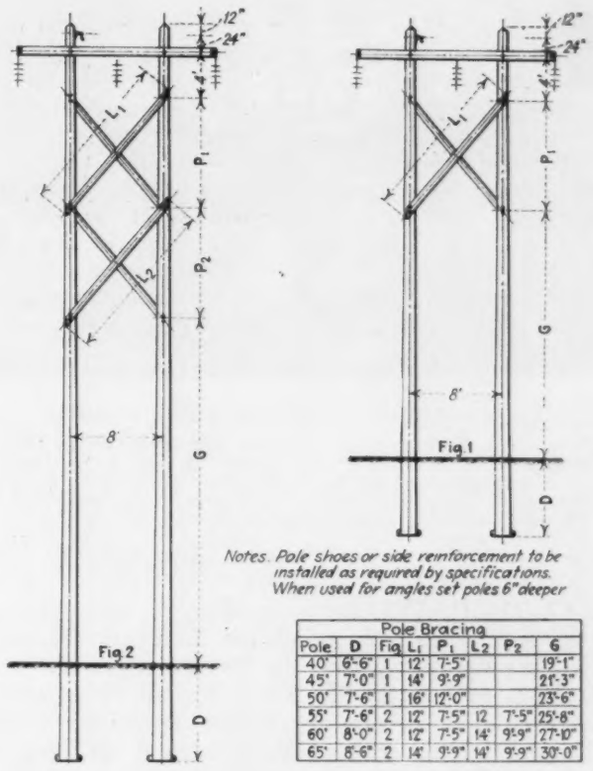
The ability of the designing engineers to co-ordinate properly the various elements of the complete plant, their proper conception of the relation of the plant or plants to the system as a whole and the undertaking of the project in sufficient time for a proper study of fundamentals in advance of construction requirements, all have an effect on the cost of the completed project.

▼ ▼ ▼

Bracing More Economical than Class A Poles

H-frame transmission line structures, normally using class B poles, may be required to include class A poles at crossing and other special locations. When the two classes are used in a single job there is a fine opportunity for erection crews to get them mixed and it has happened that an inspector finds a pole of one class in a place that should be occupied by one of the other. To obviate this possibility and also to save some of the difference in cost between class A and class B poles, the Management & Engineering Corporation, Chicago, specifies the latter class for the whole job and reinforces the line structures with cross-bracing at points where class A poles would be required.

The bracing used, which, with labor of application, costs much less than the price difference between the two classes of poles, is 3x6-in. plank. The drawing shows the method used for bracing on various pole lengths. The bracing, as may be noted, becomes double for higher poles, but for convenience in designation this design is referred to as "single bracing." "Double bracing" means that for greater strength the bracing is double on the shorter poles and triple on the longer. These arbitrary designations are used in the accompanying bill of material.



Notes. Pole shoes or side reinforcement to be installed as required by specifications. When used for angles set poles 6" deeper

Pole Bracing

Pole	D	Fig.	L_1	P_1	L_2	P_2	G
40'	6'-6"	1	12'	7'-5"			19'-1"
45'	7'-0"	1	14'	9'-9"			21'-3"
50'	7'-6"	1	16'	12'-0"			23'-6"
55'	7'-6"	2	12'	7'-5"	12'	7'-5"	25'-8"
60'	8'-0"	2	12'	7'-5"	14'	9'-9"	27'-10"
65'	8'-6"	2	14'	9'-9"	14'	9'-9"	30'-0"

Bill of Material

Single Circuit

Bracing	Single Braced						Double Braced					
Pole height, feet	40	45	50	55	60	65	40	45	50	55	60	65
Bolt, double arming, ⅞x20 in.	1	1	1	2	2	2	2	2	2	2	2	2
Bolt, double arming, ⅞x22 in.	..	..	..	..	..	..	..	..	..	..	..	1
Bolt, machine, ⅞x14 in.	4	4	4	4	4	4	4	4	4	4	4	4
Bolt, machine, ⅞x16 in.	4	4	4	4	4	4	4	4	4	..	..	..
Bolt, machine, ⅞x18 in.	..	..	..	4	4	4	4	4	4	8	8	8
Bolt, machine, ⅞x20 in.	..	..	..	..	..	..	..	..	..	..	..	4
Plank, 3x6 in.x12 ft. 0 in.	2	..	..	4	2	..	4	2	..	..	..	2
Plank, 3x6 in.x14 ft. 0 in.	..	2	..	..	2	4	..	2	4	2	..	4
Plank, 3x6 in.x16 ft. 0 in.	..	..	2	..	..	..	..	..	..	2	4	..
Washer, 3x3x¼ in.—$\frac{13}{16}$ in.	20	20	20	32	32	32	32	32	32	32	32	44

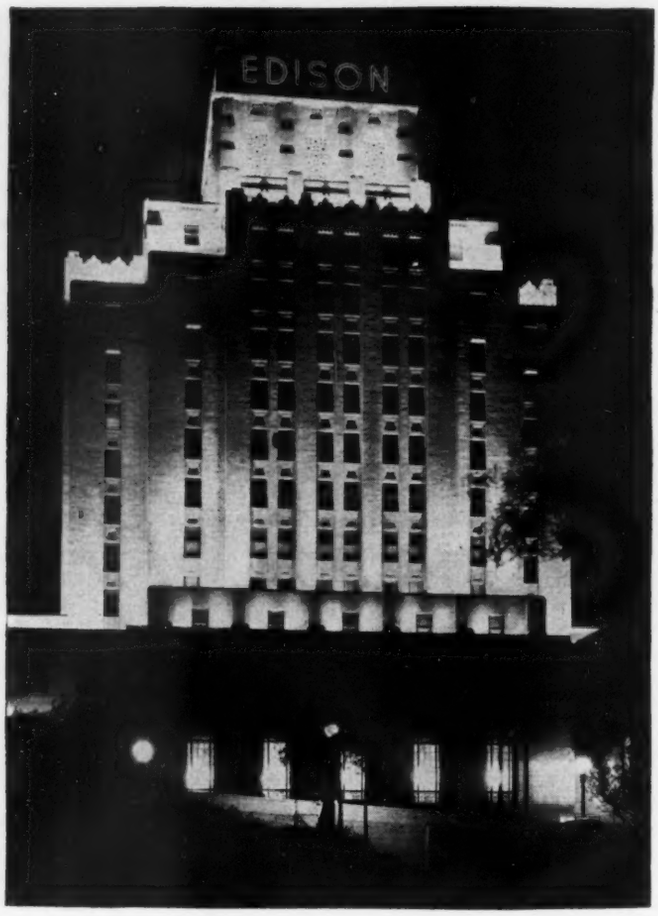
Double Circuit

Bracing	Single Braced						Double Braced					
Pole height, feet	40	45	50	55	60	65	40	45	50	55	60	65
Bolt, double arming, ⅞x20 in.	1	1	1	1	1	2	2	2	1	1	1	1
Bolt, double arming, ⅞x22 in.	..	..	..	..	..	..	..	..	1	1	1	2
Bolt, machine, ⅞x16 in.	8	8	8	8	8	4	4	4	4	4	4	4
Bolt, machine, ⅞x18 in.	..	..	..	..	..	4	4	4	4	4	4	..
Bolt, machine, ⅞x20 in.	..	..	..	..	..	4	4	4	4	4	4	12
Plank, 3x6 in.x12 ft. 0 in.	2	2	..	..	..	4	4	4	2	..	..	2
Plank, 3x6 in.x14 ft. 0 in.	..	..	2	..	..	..	..	..	2	2	..	4
Plank, 3x6 in.x16 ft. 0 in.	..	..	..	2	2	..	..	..	..	2	4	..
Washer, 3x3x¼ in.—$\frac{13}{16}$ in.	20	20	20	20	20	32	32	32	32	32	32	44

Single and Double Circuit

Side Reinforcement, Loadings	In Both Directions						In One Direction					
Pole height, feet	40	45	50	35	60	65	40	45	50	55	60	65
Bolt, machine, ⅞x22 in.	4	4	..	..	..	..	..	..	..	..	..	..
Bolt, machine, ⅞x24 in.	..	..	4	4	4	4	..	..	..	..	..	..
Plank, 3x12 in.x4 ft. 0 in.	2	2	2	2	2	2	2	2	2	2	2	2
Spike	..	..	..	..	..	..	4	4	4	4	4	4
Washer, 3x3x¼ in.—$\frac{13}{16}$ in.	8	8	8	8	8	8	..	..	..	..	..	..

Shoes	Single and Double Circuit					
Pole height, feet	40	45	50	55	60	65
Bolt, double arming, ⅞x24 in.	4	4	4	4	..	..
Bolt, double arming, ⅞x26 in.	..	..	..	..	4	4
Bolt, machine, ⅞x22 in.	4	4	..	..	..	..
Bolt, machine, ⅞x24 in.	..	..	4	4	4	..
Bolt, machine, ⅞x26 in.	..	..	..	..	..	4
Plank, 3x12 in.x4 ft. 0 in.	4	4	4	4	4	4
Washer, 3x3x¼ in.—$\frac{13}{16}$ in.	24	24	24	24	24	24



Contrasts produced by steady illumination

The entire building face is evenly illuminated when the mobile lighting circuits are energized and a gradual change is produced as the mobile lighting is dimmed or increased. Attractive blends of color are also produced by using different color filters on the mobile and steady lighting circuits.

New Ideas in Floodlighting

By H. T. CRANE

Engineering-Construction Department, Southern California Edison Company, Ltd., Los Angeles, Calif.

INCORPORATED in the floodlighting installation on the new office building of the Southern California Edison Company, Ltd., in Los Angeles, are some new ideas and methods. These include "thyratron"-reactor control for mobile circuits, automatic control with periodic changing effects, method of securing changing effects with a single color and method of mounting units.

The building is 174x176 ft. on the ground floor with a 3-ft. setback at the third floor and 20-ft. setbacks at the fourth, twelfth and thirteenth floors. The floodlighting load is 233.2 kw., made up of 175 1,000-watt units, 62 500-watt units, sixteen 300-watt and 112 200-watt units, or a total of 365 units. The wattage per square foot on the main walls of the building is 3.5, on the upper setbacks 5 and increasing to 7 watts per square foot on the tower. At each 20-ft. setback two banks of floodlights are installed, one close to the building at the base of the area to be lighted, and directed almost vertically, and another at the outer edge of the setback and directed so as to cover the upper portion of the area. The outer banks are on mobile control, while the inner units are on steady circuits.

With a single color, or clear, on all units the appearance of each wall area when the mobile banks are at dim is one of intense light at the base, gradually shading off toward the top, with long shadows, while at the bright point of the cycle the intensity appears uniform from top to bottom and the shadows are shorter. With one color on the mobile banks and another on the steady a variety of changing shades and blends is produced as the intensity of the mobile circuits varies. Due to the different location of the steady and mobile banks the change does not take place over the whole lighted area, but rather starts at the top and gradually spreads down through various shades to the color on the steady units at the base. The result is a series of attractive blends rather than flat areas of one color.

The first color scheme used on the building, on the occasion of the 150th anniversary fiesta of the city of Los Angeles, was made up of green on the steady circuit and a light amber on the mobiles, while the upper corners were in a light lavender shade. The beauty of the structure in these colors caused favorable comment and added much to the civic decorations for this colorful celebration.

Floodlighting circuits are divided into nine major groups: Tower (mobile), twelfth floor (mobile), lower walls (mobile), lower corners (mobile), tower (steady), twelfth floor (steady), upper corners (steady), lower walls (steady) and lower corners (steady). Each of these is controlled by a contactor, which is in turn controlled through the floodlighting panel located at the main switchboard in the basement. The operation of each mobile circuit is governed by a small regulator, four of which are grouped, and driven through a set of gears by a "telechron" motor. By changing these gears each can operate at a different speed or all at the same speed, as desired. The operation of these varies the d.c. output of a pair of "thyratron" tubes, which, through reactors, govern the intensity of the mobile circuits. Cycles of one minute up to 30 minutes can be obtained with the various sets of gears. Two sets of these regulators are provided, so that each can be set up for different operation and the control shifted from one to the other during the evening through time clocks, if desired.

The wave, shape and intensity of the mobile cycles can be quite easily adjusted by means of small

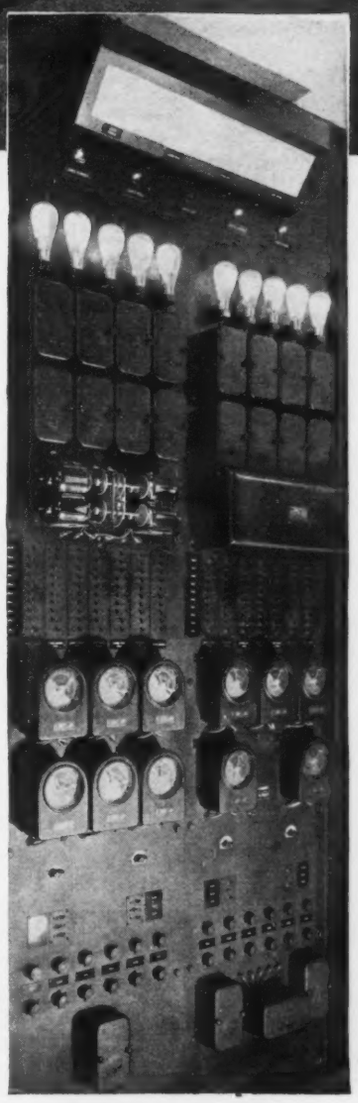
potentiometers. A ground glass panel which is divided into four sections, with an indicating lamp on a mobile circuit in each, is mounted at the top of the panel.

The entire control is made automatic through the operation of eleven synchronous time clocks which start the system, energize and de-energize the nine circuits or go through ten changes as set up on 140 toggle switches, at times set up on the clocks. The contactors, reactors and distribution panels for the lower lights are adjacent to the control panel, while those for the upper part of the building are in the tower and are supplied from the main lighting riser bus at that point. Only a few small control wires for the contactors and reactors are required between the panel in the basement and the tower for operation of the upper lights.

The floodlighting units are mounted on precast concrete bases 18 in. in diameter and 5 in. thick. These are sufficiently heavy to hold the units solidly in position, but can be easily moved if it is desired to shift the position of the lights. These bases are inexpensive and eliminate all anchor bolts in the roof, which are often a source of troublesome leaks. The floodlighting units are constructed to take a "pyrex" color lens behind the permanent clear lens. This can be quickly slipped in place without the use of tools.

The Edison Building is lighted each night until midnight. The system has been in operation for a year to date and has been entirely satisfactory, the only maintenance required being the replacement of lamps in the lighting units. The simplicity of the equipment, together with the economy of operation, extreme flexibility of control and ease of setting up varied effects, makes the installation ideal from every standpoint.

Concrete bases provide movable floodlight supports and eliminate possible damage to roof



Automatic floodlighting control panel

Seen from top to bottom are: Indicating panel for mobile circuits, indicating lights for steady circuits, relays, two sets of regulators for mobile circuits, one with cover removed, preset switches, "telechron" time switches, dials for hand-operated regulators, switches for hand or automatic operation and potentiometers for wave shape and intensity control.

Fog Penetration of Different Lights

Apropos of the persistent reports that neon illumination and filtered white light is more visible through fog than white light, S. Herbert Anderson, at a meeting of the A.S.M.E. aeronautic division, reported wholly negative results. His study led to the following conclusions:

1. Visible light is less effective than ultra-violet and infra-red radiation in fog penetration.

2. The transmission of various colors of visible light through large-particle fogs is about the same for all colors. In small-particle fogs the transmission of red light is about 25 per cent higher than other colors. In general, there is no color of visible light especially effective in fog penetration. Hence colored beacons are of no greater value in marking airways than are white light beacons, as judged from the relative transmissions.

3. In dense, large-particle fogs ultra-violet has a transmission greater than that of visible light.

4. The penetration of infra-red radiation through fog is many times that of visible light, the ratio depending upon the distance and the nature of the fog. Consequently, infra-red gives promise of great value in developing aids for fog landing, especially in localizing a fog-obscured airport.

Weatherproof Wire Can Be Improved

By C. G. HARDING, L. L. CARTER and J. W. OLSEN*
Purdue University, Lafayette, Ind.

Weatherproof wire has been a sore subject for years. Arguments have raged pro and con over its value for primary circuits, the opponents contending it gives a false sense of security, the advocates saying it serves its purpose if properly selected and maintained. To the criticism that it lacks permanence manufacturers have retorted that good wire can be furnished if the price is paid for it.

Here is a real research report on the subject, not only telling what is wrong with present wire but also making a definite recommendation toward its improvement.

PRESENT triple-braid weatherproof-wire covering may be materially improved by the use of higher fusing point blown asphalts, free of waxes and low boiling fluxes, as saturants. Such saturants will provide a covering of uniformly long life. It has been proved that the higher saturating temperatures required to apply such saturants may be used without damage to the cotton yarns and without excessive annealing of the copper conductors. Specifications for weatherproof coverings will soon be written to guarantee weatherproof wire of long life to the utility. Future work will provide a covering of lighter weight and smaller size but of higher insulating value and longer life than present construction.

Concentration of effort upon the reduction of weatherproof wire costs during the years following 1918 or 1920 bore fruit in the early loss of saturating compound and the shedding of braids, in many cases, within a period of two to three years after the erection of the lines. Development work lay in the hands of the manufacturer and was centered upon cutting costs to meet the demand for a cheaper product, which would meet the very meager specifications available.

As more and more early failures of weatherproof wire coverings were seen to occur in extremely short lengths of time, the sentiments of many operating engineers swung toward discontinuing a weatherproof covering on overhead lines and adopting bare conductors for all service except where tree wire was necessary or where highly insulated conductors were required at points of inadequate spacing or clearance. Certain engineers opposed the policy of abandoning the use of weatherproof coverings on overhead lines of 4,000 volts line to line and less, for the reason that such a covering might reduce the number of service interruptions by preventing grounds and short circuits. This group believed that an attempt should be made to improve weatherproof coverings before making a decision to discontinue using such coverings.

A consideration of the following costs of weatherproof wire and its erection and removal on the lines of a large operating company for the year 1930 indicates the necessity for taking steps to improve the weatherproof covering or discontinuing its use entirely:

Total purchases of weatherproof wire:
2,700,000 lb. at average price of 14 cents per lb. $378,000.00

The detailed costs of installation and removal are as follows:

	Per Pound
Average cost of wire	$0.14
Cost of installation	0.075
Cost of removal	0.06
Total cost of wire, installation and removal	0.275
Less scrap value	0.05
Net cost throughout life of wire	$0.225

If we assume that the average life of the overhead wire is seven years, a life which an analysis of operating company records indicates to be a reasonable figure, the present net cost per year would be $0.0321 per pound.

Assuming that the life of the wire covering be doubled by improvements in materials, without an increase in the wire cost, and that more than half the purchases of this company are for wire replacement, the yearly cost per pound would be cut in half and a yearly saving of $150,000 to $175,000 would be made by this one company.

On the basis of a double life of wire with over-all yearly costs remaining as at present, an increase of 2.6 times present wire costs would be economically justified. When the life of a wire is doubled one installation and removal cost, less one scrap value, may be added to the cost of the short-life conductor which would be installed twice. This permits a charge of 2 × $0.14 plus $0.135 less $0.05 or $0.365 per pound for the long-life conductor without increasing the yearly cost per pound for wire installed. This figure for the new conductor would need to be reduced by $0.01 to $0.02 to allow for the carrying charges on the increased initial expenditure of $0.365 less $0.14 or $0.225 per pound.

It should be further noted that for an increased wire cost of 2.6 times with the cost of the copper conductor unchanged and the weight of the covering averaging 25 per cent or less of the total weight of conductor and covering, the cost of the covering alone may be increased to 7.4 times the cost of the present covering.

This discussion of the costs of the present construction shows the saving that may be made by improving

Abstract of paper presented at a recent A.I.E.E. regional convention, Milwaukee, Wis.

the weatherproof wire covering and the economic limits to increasing the cost of the covering.

On the insistence of engineers among the companies represented by the Utilities Research Commission,* that weatherproof wire coverings should be developed to provide longer life and higher insulating values, the commission initiated a study of this problem at Purdue University. This study was started October 1, 1929, under the direction of the electrical division of the Engineering Experiment Station with the chemical division co-operating.

Complete testing equipment was purchased or constructed for the laboratories at Purdue University. This equipment includes apparatus for both accelerated and natural weathering of finished wires and wire-covering materials, for subjecting the wires to rubbing and abrasion (as in drawing over crossarms or rubbing against trees, and also to the abrasion that occurs at the point where the wire is tied to the insulator), for bending and wrapping at freezing temperatures, for producing decentralization such as occurs in service, and for making complete physical and chemical tests on the wire-covering materials.

Faults lie in saturants

The work at the university indicates positively that the poor physical properties of the saturants used in weatherproof wire coverings in the past have been the cause of the extremely early failure of weatherproof wire. The coverings of wires which last well are eventually caused to fail by a combination of physical changes, by the saturants shifting in the coverings, etc., and by chemical changes in the saturant caused by exposure to light, oxygen of the air, etc., but in very early failures the effects of light and oxygen are of less importance than the effects of poor physical properties, which cause the saturant to shift in the braid when hot and to crack and split when cold.

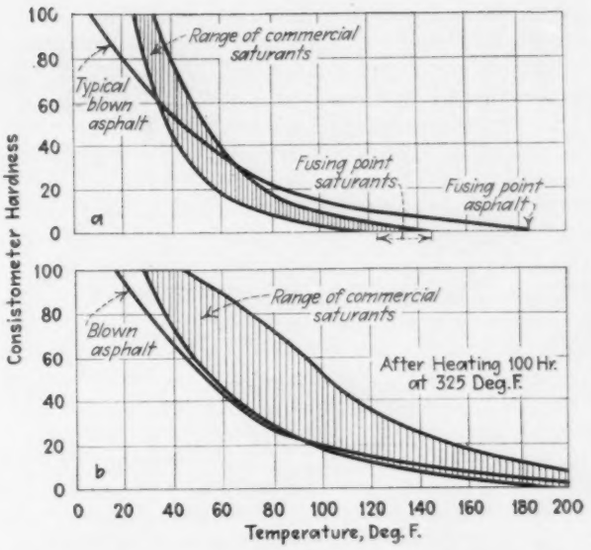
These poor physical properties of the saturants are: Too low fusing points, extreme softness when warm, great changes in hardness with changes in temperature, extreme brittleness at even moderately low temperatures and a marked tendency to evaporate. The majority of saturants used have had softening points (as determined by the ball-and-ring method) ranging from 130 to 150 deg. F., lower than maximum wire-operating temperatures. These materials shift in the braids, leaving the upper braids unprotected, at ordinary summer temperatures, which are well below the fusing point. The extreme brittleness of these saturants, which result in cracking or breaking of the braids in cold weather, may be illustrated by the fact that less than two degrees bending is required to break molds of these saturants in the pliability test at zero degrees F.

Many of the poor physical properties, particularly the disappearance or evaporation of the saturant from the braids, have been caused by the addition of excessive amounts of waxes, wax tailings or low melting fluxes to obtain fluidity and ease of saturation. These low boiling materials soon leave the saturant, causing the body of the asphalt to disintegrate. The saturants vary in their resistance to the weathering effects of light and oxygen and the worst are subject to excessive surface deterioration and erosion. The result of all these factors is the loss of compound, particularly from the upper side of the braids, with the resultant breaking of the braids

Public Service Company of Northern Illinois, People's Gas Light & Coke Company, Chicago Rapid Transit Company, Commonwealth Edison Company, Middle West Utilities Company, Midland United Company.

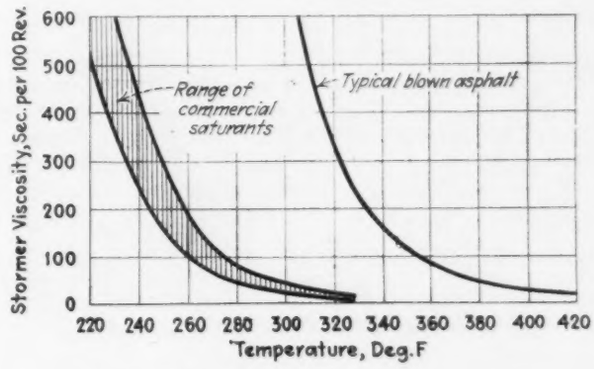
Properties of Commercial Saturants Compared to a Typical Blown Asphalt

	Range of Saturants	Blown Asphalt
Ball-and-ring fusing point, deg. F	120–150	192
Pliability at 0 deg. F., degrees	½–1½	23
Consistency-Abraham Hardness:		
20 deg. F.	Above 100	80
60 deg. F.	17–40	35
100 deg. F.	4–9	15
Loss by evaporation:		
100 hours at 325 deg. F.	0.25–4.0	None
Ball-and-ring fusing point after heating, deg. F.	190–230	224
Consistency after heating:		
20 deg. F.	Above 100	95
60 deg. F.	43–90	42
100 deg. F.	18–55	18
Viscosity:		
Temperature at which a viscosity of 100 sec./100 rev. is obtained	260–278	357



Hardness characteristics of blown asphalt and commercial saturants before and after heating 100 hours at 325 deg. F.

The blown asphalt is less brittle at lower temperatures, has a higher fusing point and is less affected by heating.



Blown asphalt has greater viscosity than commercial saturants

Being more viscous, blown asphalt will be less liable to displacement in the impregnated braid.

on the upper side and the familiar festooning. The use of materials subject to such faults has been permitted by specifications which did not specify the source nor physical properties of saturants. Proper specifications have not been written because of a lack of knowledge essential to the writing of such specifications. The work at Purdue University is to provide such a specification.

Finishing waxes cannot be regarded as of great protection to the covering because they evaporate or crack and flake off within a short time or are damaged in installation. The wax has cracked, chipped off or simply disappeared from the surface of the wire on the various samples in the natural exposure rack in from three to eight months. It has been found that the cotton yarns are not so important in producing a long-lived covering as are the saturants used. It is important, however, that sufficient cotton be present in the two inner braids to absorb and hold the saturant and that the outer braid should be closely woven to resist abrasion and erosion. The one fault of the braided construction is that it does not consistently afford insulation beyond that of the air spacing provided because of the interstices always present. It is desirable to have a more solid and homogeneous material next to the conductor.

Improved saturants

Intensive experimental work, in the past year and a half, with many asphalts of different types from different sources, tested in both accelerated and natural weathering exposures, has shown conclusively that the length of life of weatherproof wire coverings may be materially increased by using, for a saturant, blown petroleum asphalts having a ball-and-ring softening point of 180 to 200 deg. F. free of low boiling materials and without the addition of wax tailings in the wire plant.

Several of the weatherproof wire makers have offered to produce a quantity of experimental weatherproof wire on a commercial scale. It has been decided, therefore, to produce a carload of wire, using as a saturant the asphalts which have been found to provide the longest-lived wire coverings. This saturant will be a blown petroleum asphalt having the above range of ball-and-ring softening points; a hardness, as determined by the needle penetrometer, of 35 to 25 at 77 deg. F. with 100 grams loading for five seconds; chosen for the greatest pliability at low temperatures and for freedom from low boiling materials. The experience gained in the production of this wire will be an aid in the writing of a specification for an improved weatherproof wire covering.

Such an asphalt, of greater stability at higher wire temperatures, will greatly reduce the shift of the saturant in the braids and will be less subject to evaporation and erosion. In addition, these asphalts are less susceptible to temperature changes and are much less brittle at low temperatures. Such asphalts may be bent many degrees in the pliability test, while commercial saturants cannot be bent more than two degrees.

New and different types of coverings

While the development work carried on thus far has been concentrated upon providing an improved asphaltic base saturant which could be applied to the present triple-braid covering without great changes in the weatherproof wire plant, experimental work with other types of weatherproofing saturants and with coverings other than triple braid has been carried on.

Bakelite and other synthetic resins, Harvel compounds and varnishes and other materials have been applied to weatherproof wire coverings. The use of these materials as saturants for a single outer braid, applied over an insulating cover on the conductor, provides a highly protective coating because of the excellent weathering quality of such materials.

Experiments with conductors having a paper tape covering next to the conductor and a single outer braid weatherproofed with these very high quality saturants have shown that coverings of consistently high insulating value can be obtained and that the paper next to the conductor does not deteriorate appreciably in the time of one accelerated weathering test.

Most of these high-grade saturants can only be applied on one braid because of their high cost.

22 Applications for Interlocking Systems

To prevent

1. Opening of disconnects if corresponding oil breaker is closed.
2. Closing of ground switch on energized circuit.
3. Opening of air-break switch under load before oil breaker on low side of transformer opens.
4. Closing of air-break switches on two supplies to same transformer bank.
5. Withdrawal of truck-type breaker unless it is open.

To prevent

6. Opening potential transformer compartment doors when resistor disconnects are closed.
7. Closing of bus grounding disconnects unless all bus feeder disconnects are open and prevent closing feeder disconnects on a ground bus.
8. Closing of feeder disconnects on a grounded feeder or vice versa.
9. Opening disconnects on a circuit adjoining circuits opened for maintenance purposes, etc.

To prevent

10. Opening under load of motor-operated disconnects between a circuit and the inspection or auxiliary bus.
11. Starting and running oil circuit breakers on synchronous condenser from being closed at same time.
12. Removal of switch cell doors or opening of disconnects unless breaker is open.
13. Closing of breakers on two or more supplies to same transformer bank.
14. Operation of tap changers under load when not so designed.

To prevent

15. Opening exciting winding of induction regulators before set on neutral.
16. Opening of disconnects on exciting current where not suitable for purpose.
17. Improper operation of disconnects to shunt out an oil breaker for maintenance.
18. Improper operation of disconnects used to connect circuit to auxiliary bus.
19. Connecting leads of spare transformer with wrong buses.

To prevent

20. Contact of employees with live equipment.
21. Wrong sequence of ground and disconnect switch operation.
22. Out-of-phase relations when paralleling tap-changing transformers.

Carrying Capacities of Inclosed Buses

By A. P. FUGILL
Engineering Division,
Detroit Edison Company, Detroit, Mich.

ALL OF the data on bus heating that have been published are based on buses operating in still but unconfined air. However, most buses actually operate inclosed in a housing of some character. In the case of the practice developed and now employed by the Detroit Edison Company the housing is comparatively tight and prevents the escape of the air surrounding the bus to a very large extent. Hence the heat is largely dissipated by conduction through the housing material and radiation from its exterior. Obviously under such a condition the bus will have a lower rating than in open air. Since no information on the amount of this reduction was available tests were made on certain types and configurations of bus in a metal housing. The housing was that used by the company in 24-kv. construction and tests were made in both magnetic (steel) and non-magnetic (aluminum) inclosures.

A bus is usually rated on the basis of the maximum temperature rise at any point on its surface. Since all parts of the bus are seldom at the same temperature some may be considerably cooler than others. It is considered good practice to rate a bus on the current it will carry with a maximum temperature rise of 30 deg. C. above an ambient temperature of 40 deg. C. where the bus is immediately adjacent to switchgear, since this equipment is rated at a 30-deg. C. rise. The hottest point on the bus will thus have a total temperature of 70 deg. C. There is no reason why the bus itself may not be run at a higher total temperature if the bus temperature does not affect connected switchgear. This is particularly true when all joints are tinned. Furthermore, the size of a bus is ordinarily determined by an emergency loading, which occurs infrequently and then only for comparatively short periods. It is reasonable, therefore, in the majority of installations to base the bus design on a 35-deg. C. rise. The data presented in this article are based on that figure. In the few cases where the bus is to be continuously loaded to its rating and is in close proximity to switchgear it would be desirable to multiply the capacities here given by the factor 0.91, which will give the capacities on the basis of a 30-deg. C. rise.

The number of tests made was comparatively small and hence the conclusions drawn from them cannot be accepted as unquestionably established to the last detail. However, the conclusions do show the trend for the conditions tested and they can be used in most cases to give reasonably accurate results. These conclusions can be best presented as follows:

1. The ratio of the rating of a bus in the non-magnetic housing to that in open air varies with the type of bus. For simple bus arrangements such as those shown in the curves and tables, with the exception of the last two items in Table II applying to flat buses, this ratio is about 75 per cent. For special configurations similar to those of items 8 and 9, where the open-air rating is largely dependent upon the ventilation along the face of the bars

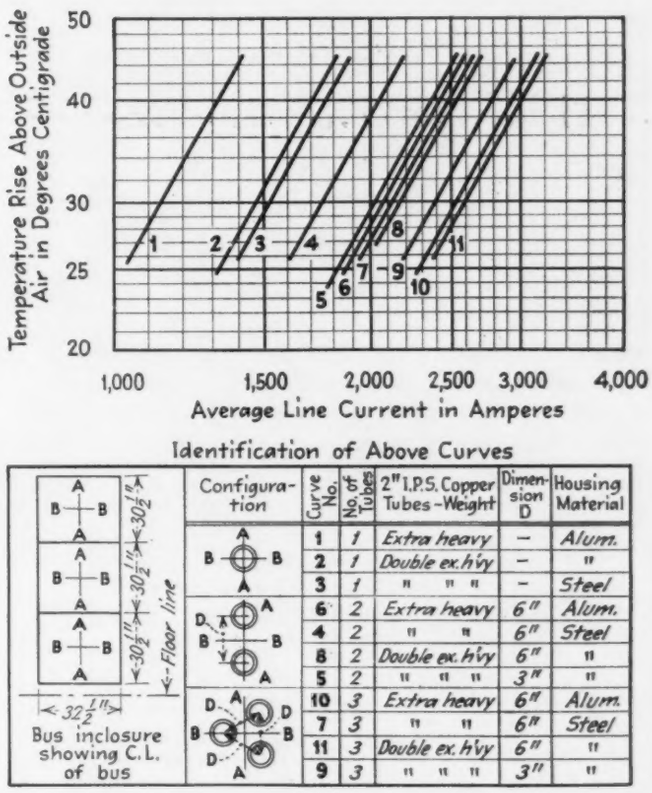


Fig. 1—Temperature-current relations for inclosed 2-in. copper-tube bus

Table I—Test Data on 2-In. Tubular Copper Buses

Refer to Fig. 1 for configuration of buses and temperature rise at different currents

Curve No.*	Number of Tubes†	Center Spacing (In.)	Cross-Section (Sq.In.)	Carrying Capacity in Housing with 35 Deg. C. Rise (Amp.)	Current Density (Amp. per Sq.In.)	Loss per Ft. of 3-Phase Bus at Capacity Listed (Watts)
			Magnetic Housing			
3	1-D.E.H.	..	2.68	1,650	616	...
4	2-E.H.	6	2.98	1,900	635	161
8	2-D.E.H.	6	5.36	2,350	439	182
5	2-D.E.H.	3	5.36	2,200	410	126
7	3-E.H.	6	4.47	2,300	513	218
11	3-D.E.H.	6	8.04	2,800	348	261
9	3-D.E.H.	3	8.04	2,600	322	232
			Non-Magnetic Housing			
1	1-E.H.	..	1.49	1,230	824	...
2	1-D.E.H.	..	2.68	1,600	600	...
6	2-E.H.	6	2.98	2,250	752	61
10	3-E.H.	6	4.47	2,750	614	74

* Refers to Fig. 1, which permits identification of configuration.
† E.H. = extra heavy; D.E.H. = double extra heavy.

Table II—Test Data on Flat-Bar Copper Buses in Non-Magnetic Housing

Refer to Fig. 2 for configuration of buses and temperature rise at different currents

Curve No.*	Number and Size of Bars (In.)	Cross-Section (Sq.In.)	Carrying Capacity in Housing with 35 Deg. C. Rise (Amp.)	Current Density (Amp. per Sq.In.)	Loss per Ft. of 3-Phase Bus at Capacity Listed (Watts)
1	2½x6	3	1,930	643	67
2	3½x6	4.5	2,250	500	85
3	4½x6	6	2,800	467	98
4	4½x6	6	3,000	500	106
5	2½x3 2½x6	4.5	3,200	710	110
6	4½x3 2½x6	6	3,340	558	131
9	4½x6	6	3,600	600	206
8			3,320†	554†	181†
7	4½x6	6	3,300	550	111
9	8½x4	8	3,600	450	126

* Refers to Fig. 2, which permits identification of configuration.
† Top of housing heat insulated.

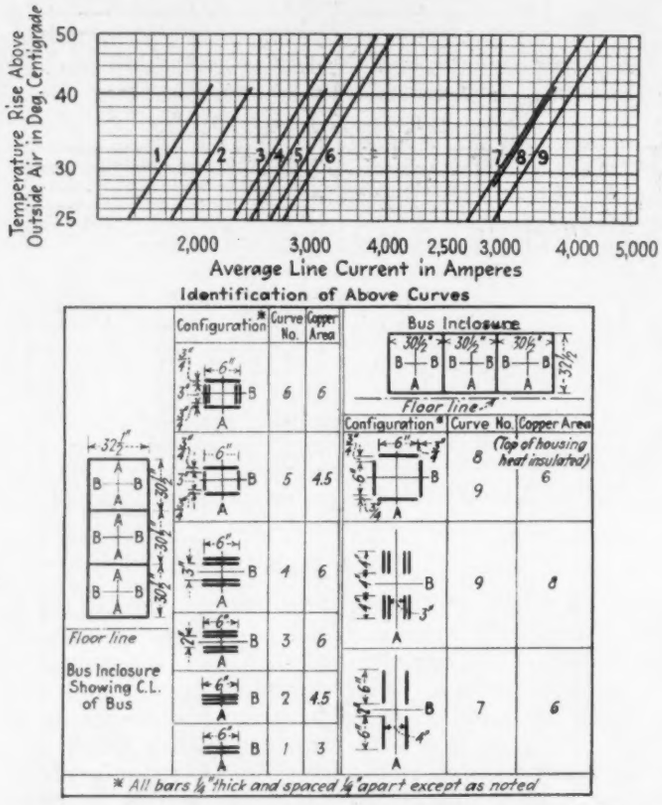


Fig. 2—Temperature-current relations for flat-copper busbar in aluminum housing

and not so much upon uniform current distribution, the ratio is about 60 to 65 per cent.

2. The ratio of the rating of a bus in the magnetic housing to that in the non-magnetic housing is about 85 per cent. When the current is low and the conductor is remote from the housing walls, as in the case of the single-tube bus, this ratio may be as high as 100 per cent.

3. The temperature rise varies about as the 1.7 power of the current. That is,

$$\left(\frac{I_1}{I_2}\right)^{1.7} = \frac{T_1}{T_2}$$

4. The ratio of effective alternating-current resistance to direct-current resistance for the buses in the non-magnetic housing varies from about 2:1 to 3:1 for the buses tested. The effect of the magnetic housing, due to the additional magnetic loss in the housing, is to raise these ratios to about 5:1 and 11:1 respectively.

5. With tubular bus construction the ratio of current rating for extra heavy tubing to that of double extra tubing is about 80 per cent, although there is only 50 per cent as much copper in the thinner tubes.

6. For tubular bus in multiple arrangement the ratio of the rating at 3-in. center-to-center spacing to that at 6-in. center-to-center spacing is about 93 per cent.

The Detroit Edison Company has used the conversion factors set forth in the first and second conclusions to modify previously published data on current-carrying capacities of buses in open air. The modified values thus secured have been taken as estimated capacities for buses of different sizes and configurations operating inside of magnetic and non-magnetic housings. The estimated capacities thus obtained are necessarily approximate, but are believed to be safe values for most designs of 24-kv. and 12-kv. buses. It would probably be safe for any designing engineer to take the ratios set forth in the above conclusions to modify bus current capacities in still air for the range of voltage mentioned. For buses below 12 kv. there should be a further reduction in capacity because of the inherent reduction in size of housings and spacing between buses. This reduction is of the order of 10 per cent for heavy current conductors.

▼

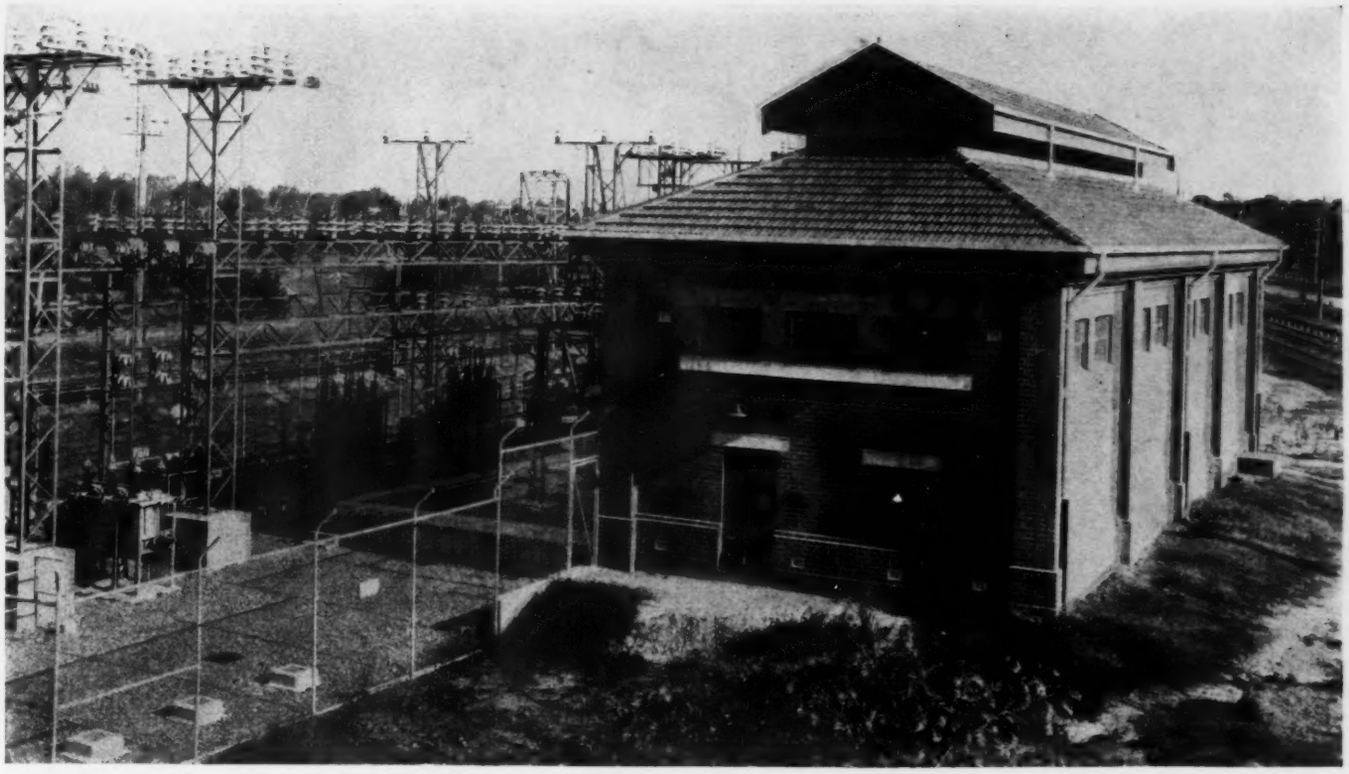
Railway Substations in New South Wales

Mercury-arc rectifiers used.
High overload ratings guaranteed.
Two years' operation satisfactory.

By N. VON KOTSCHUBEY
Zurich, Switzerland

A large part of the New South Wales government transport services, including the tramway systems of Sydney and Newcastle, as well as the Sydney suburban lines, have been electrified. Electrification of the suburban lines was started in 1922 and, at the present time, consists of 205 miles of single track. The power supply is derived from two steam power stations at Ultimo and White Bay and the energy is supplied to the tramways and suburban line substations through 6,600-volt underground cables or 33,000-volt, three-phase overhead lines. In the a.c.-d.c. converting substations, in addition to a large number of rotary converters, sixteen mercury-arc rectifier units having a total output of 23,100 kw. at 1,500 volts d.c. are in use. Of fifteen of these units, each with an output of 1,500 kw., thirteen are fully automatic and are distributed among six substations connected through a large number of d.c. feeders to the trolley wire of the suburban lines of the New South Wales Government Railways.

Two of the units have been erected in a manually operated, already existing substation and work in parallel with rotary converters. The full automatic units have

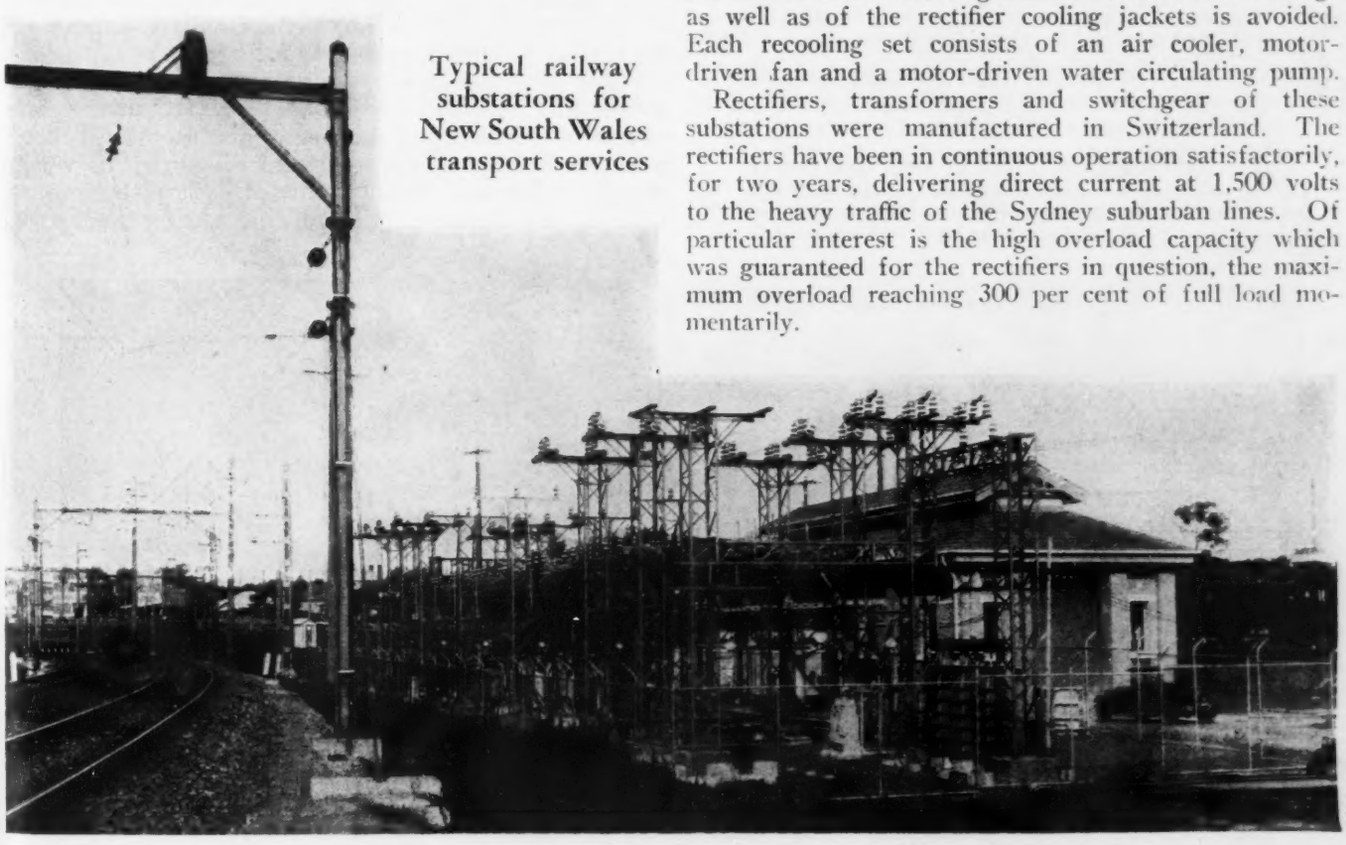


been erected in entirely new buildings. Each rectifier is connected to a rectifier transformer provided for outdoor erection and protected on its high-tension side by means of a three-pole outdoor circuit breaker. The switchboards and the d.c. switchgear, consisting of high-speed d.c. circuit breakers, have been mounted inside the building.

Water is necessary to cool the rectifiers in order to keep them at a maximum temperature of 66 deg. C. Fresh water is not available on the side, therefore special recooling sets have been provided for each rectifier. By the use of these recooling sets corrosion of the fittings as well as of the rectifier cooling jackets is avoided. Each recooling set consists of an air cooler, motor-driven fan and a motor-driven water circulating pump.

Rectifiers, transformers and switchgear of these substations were manufactured in Switzerland. The rectifiers have been in continuous operation satisfactorily, for two years, delivering direct current at 1,500 volts to the heavy traffic of the Sydney suburban lines. Of particular interest is the high overload capacity which was guaranteed for the rectifiers in question, the maximum overload reaching 300 per cent of full load momentarily.

Typical railway substations for New South Wales transport services



Regional Energy Co-ordination an Accomplished Fact

By A. H. DYCKERHOFF
Chicago, Ill.

Principles of energy structure blending applied in Chicago district have improved steel plant economy, have, so far, secured close to 50,000 kw. in electric utility load and have increased commercial gas supply. Effect of natural gas on the situation.

EXCHANGE of energy between steel plants and gas utilities, the economics of which have already been set forth,* has already been worked out practically in the Chicago region, culminating in a co-ordinated structure as shown in the diagram and with which work the author has been closely identified. It embraces six basic steel plants with a total daily capacity of about 9,900 tons of pig iron. Two of these plants have 25-cycle electric systems and are tied only with the gas utilities at present, although the 25-cycle system does not bar successful operation with the 60-cycle system of the electric utilities.

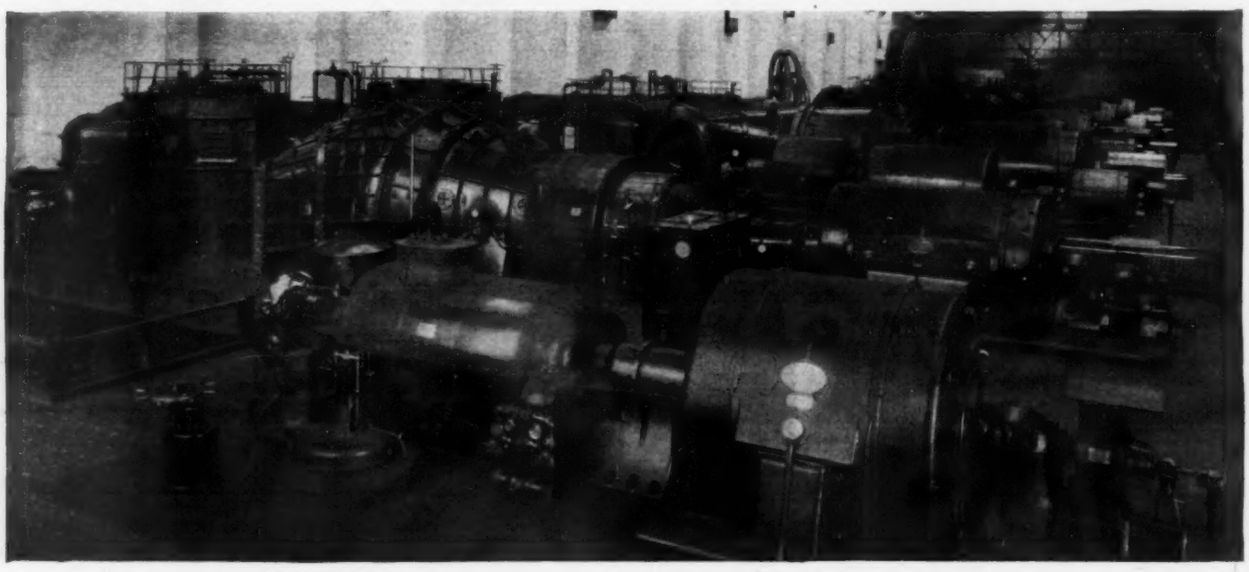
In several instances the installation of electric generating units had been planned by the steel plant either for the use of the electric energy generated within its own plant or for sale of part of the energy to the electric utilities. However, these plans were abandoned after a careful scrutiny of cost and values in line with the general considerations disclosed in the previous articles. Further results of the various projects involved in this general picture of regional energy co-ordination in greater Chicago have been the very successful use of a mixture of blast-furnace and coke-oven gas in open-hearth furnaces as shown in the accompanying sketch and the first three installations of equipment for the underfiring of coke ovens by means of blast-furnace gas, of which two have been in successful operation for several years. The diagram only incompletely exhibits the electric utility load that has resulted from application of co-ordination principles. Although the diagram shows only 38,600 kw. the total principal steel mill load is about 60,000 kw. when service to smaller mills that have no surplus of gas or none at all is included.

As is generally known, the arrival of natural gas occurred in Chicago in the fall of 1931. It is a foregone general conclusion that the supply of this gas will have a certain bearing on the volume of coke-oven gas which the gas utility can absorb from the basic plants of the iron and steel industry. In the abstract, the general prin-

**See articles on Regional Energy Co-ordination, pages 406, 449 and 491 in "Electrical World" for February 26, March 5 and 12, respectively.*

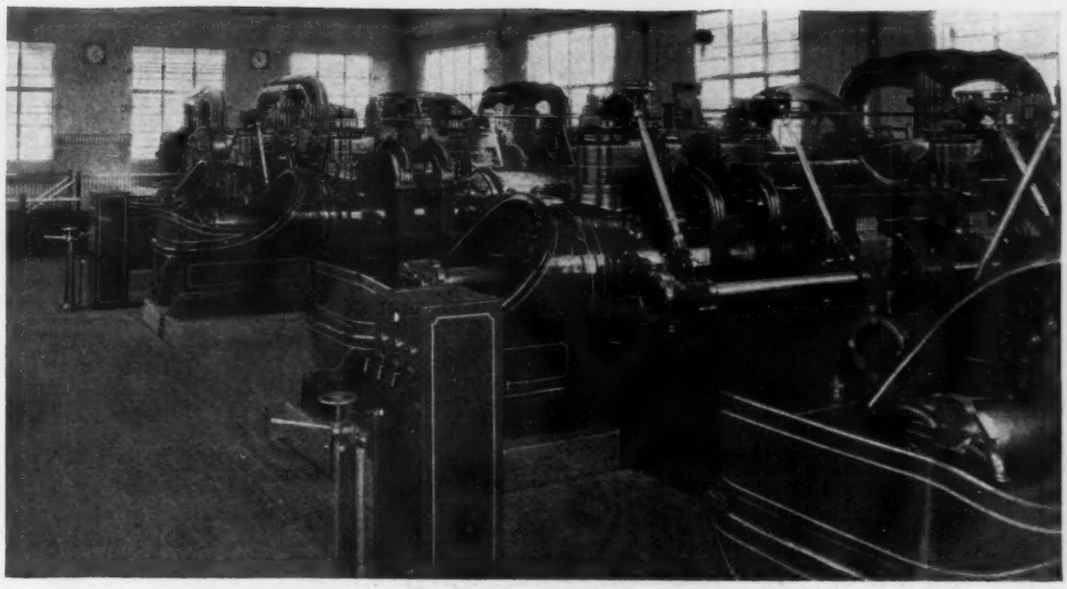
Utility station logical source of steel mill power

Energy supplied from such sources as the Crawford Avenue station of the Commonwealth Edison Company is more economical for use in the steel mill than locally generated power.



Natural gas comes to Chicago

This is one side of the combination gas engine and electric power gas compressor stations of the People's Gas Light & Coke Company at South Chicago. Here coke-oven gas purchased from steel plants is combined with natural gas to a mixture of 800 B.t.u. for distribution in Chicago.



ciples of "super-energy" hold in every respect; relatively, however, the application of these principles evolves itself into the problem of total volume of gas salable to the public and of adaptation of gas flow from the steel plants to the gas utility.

The question of purchase of electric power versus complete or partial generation within the steel plant must be decided in favor of purchase, with such extremely low rates as are in effect in the Chicago district; thus, the purchase of electric power stands in the great frame of "super-energy" on its own merits. In addition, the following three salient points deserve consideration:

First—At present the required capacity of the large steel plants in the greater Chicago district is approximately 260,000 kw. If one allows but $100 per kilowatt installed capacity and a diversity factor of 0.75, a total capacity of but 196,000 kw. would be required, permitting an annual saving of about $950,000 for fixed charges, provided a complete coupling up of the electric energy systems of these steel plants and electric utilities were established and a practical solution of the disposal of blast-furnace gas in all plants could be found.

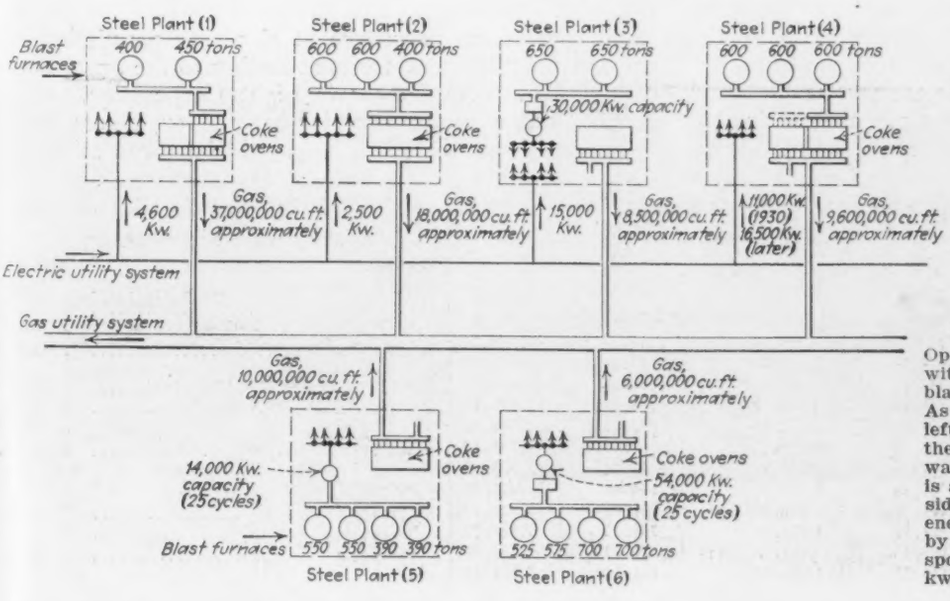
Second—Taking a steel plant with average requirements for electric power as a basis, only about .18 to 20 per cent of the total energy in blast-furnace and coke-oven gas is being consumed by the electric power. The investment necessary for the electric power plant, including reserve, is about seven to nine times the additional amount required by heating furnaces designed for blast-furnace gas for the same average energy in B.t.u. per hour.

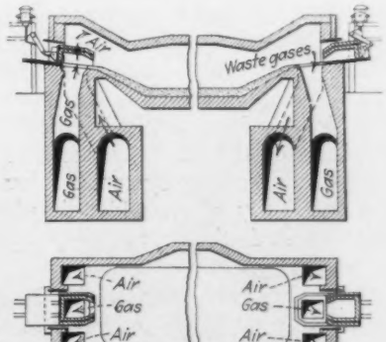
Third—The investment required for the electric power plant is about six times that necessary for the additional equipment for the blast-furnace gas underfiring of coke ovens.

Therefore, there remains but the two thoughts to be reconciled; i.e., the delivery of coke-oven gas from the

Co-ordinated regional energy in the greater Chicago district

These six steel plants purchase 38,600 kw. of electric power and sell about 90,000,000 cu.ft. of gas.



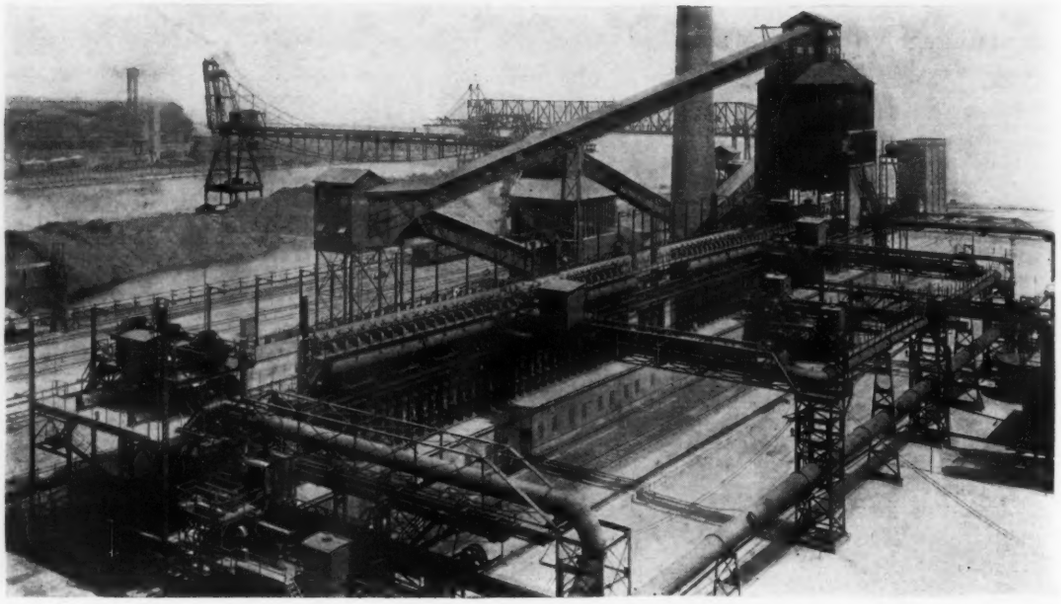


This furnace makes electricity purchase practicable

Open-hearth regenerator type furnace with "Rose" ports for efficient use of blast-furnace and coke-oven gas mixture. As shown, the furnace is fired from the left side while the brick checker work on the right side is absorbing heat from the waste gases. After sufficient heat storage is attained the firing reverses and the left side regenerators take up heat. The energy in the blast-furnace gas absorbed by one 100-ton furnace of this type corresponds to an electric load of about 1,100 kw.

Purchased power unites with coke-oven operation

These two batteries of Koppers ovens in the South Chicago (Iroquois) plant of the Youngstown Sheet & Tube Company are underfired with blast-furnace gas, thus liberating an increased quantity of coke-oven gas for sale. Purchase of electricity is an important factor in making possible the most economical use of blast-furnace gas in these ovens.



steel plants to the gas utility and delivery of natural gas to certain steel plants. Here attention must be called to the following facts:

First—Some basic steel plants with coke ovens have a deficit of energy within their own structure, as shown previously, if the by-product tar is sold, as is done generally in the Chicago district.

Second—Some steel plants have no coke-oven or blast-furnace gas available as a by-product.

Third—Since it is intended by the gas utilties to provide a gas of about 800 B.t.u. per cubic foot for distribution to the public, being a mixture of coke oven and natural gas, a certain flow of coke-oven gas from the basic steel plants is a matter of demand for gas from the gas utility by the public.

From the articles of this series certain facts are evident. No steel plant can operate at energy economy in the absolute sense if it is wholly self-contained in respect to heat and electrical energy, because it is only at one or two definite rates of steel production, impossible to maintain continuously, that balance of energy availability and demand is attained. Except at these definite rates of production deficits or surpluses of energy are always present. The ideal of economic balance is accomplished by the blending of the energy structures of steel plant and gas and electric utility systems. These articles have proved the feasibility of such blending by mathematical demonstration and they have instanced its successful performance in arrangements now existing in the Chicago area. But quite aside from the "Q.E.D." of the theorem developed in these articles and aside from the instances of actual application in the Chicago district, there is an element of high probability in any consideration of energy integration between the three systems that on its face, and without any investigation whatever, must incline thoughtful business men and engineers to the conclusion that the three industrials are mutually supplementary and should work together for the benefit of each and of the economic structure of the country at large.

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Cost of Right-of-Way Clearing

By J. H. NICHOLS
New York Power & Light Corporation

At least two advantages are derived from maintaining a separate tree-trimming department composed of men trained in tree surgery and directed by a forestry expert familiar with the procedure in obtaining permission to cut or trim customers' trees, according to the experience of the New York Power & Light Corporation. One benefit, and a major one, is that the customers have more confidence that their trees will be given scientific

Transmission Right-of-Way Clearing Costs Itemized

(Taken from Accounting Records 1930-1931)

Line No.	No. Miles	Poles or Towers	Width of Right-of-Way (Ft.)	Kerosene, Tools, Etc.	Labor	Truck	Total Cost
1	17	T	50	$21.25	$784.72	$114.24	$920.21
2	10	P	75	16.80	691.70	99.80	808.30
3	15	P	50	18.75	692.40	100.80	811.95
4	20	P	100	48.40	1,799.00	228.63	2,076.03
5	16	T	150	57.20	2,161.84	298.73	2,517.77
6	9	P	25	7.22	204.48	30.15	241.85
7	6	P	50	7.50	276.96	40.32	324.78
8	14	T	100	33.88	1,259.30	166.81	1,459.99
9	5	T	100	12.30	452.75	61.69	526.74
10	22	P	100	51.50	1,878.90	246.62	2,177.02
11	8	T	25	6.40	181.76	26.80	214.96
12	12	T	150	43.32	1,62.184	213.24	1,878.40

Sample Tree-Trimming Report for District Distribution Lines

Cost of labor	$235.00
Cost of transportation	67.50
Cost of supervision	30.00
Total	$332.50
Liability insurance (0.0566 x labor)	1.33
General overhead (0.05 x all)	16.69
Total cost	$350.52
Average unit cost	
Trees trimmed (203)	1.15
Trees topped (40)	1.80
Trees removed (3)	15.25

attention when trimming is needed and that they will not be ruined. Another advantage in divorcing this function from the line construction and maintenance crews' activities is that a fairly stable staff of specialists can be maintained by spreading their work over the whole system.

During the time when transmission right-of-way clearing is unnecessary the tree-trimming crews are used to clear tree interferences along distribution lines, remove trees during construction of rural lines, remove trees adjacent to existing lines at the request of property owners and beautify company property by grading the land for lawns, planting of trees and shrubbery. Reforestation is also a part of their job. Among their duties is clearing lines affected by fallen trees and broken branches caused by wind and sleet.

Average Unit Costs of Clearing Per Mile

Lines	Right-of-Way	Tools, etc.	Labor	Truck	Cost per Mile
6 and 11	25	$0.80	$22.72	$3.35	$26.87
1, 3, 7	50	1.25	46.16	6.72	54.13
2	75	1.68	69.17	9.98	80.83
4, 8, 9, 10	100	2.39	88.19	11.53	102.11
5, 12	150	3.59	135.13	18.28	157.00

Actual costs of right-of-way clearing using this force are given for a few typical cases. These were selected so they would represent approximately equivalent proportions of heavy, light and no clearing. About 25 per cent of each line had heavy growth, 25 per cent light growth and 50 per cent no appreciable growth due to the developed farm land through which the lines were constructed.

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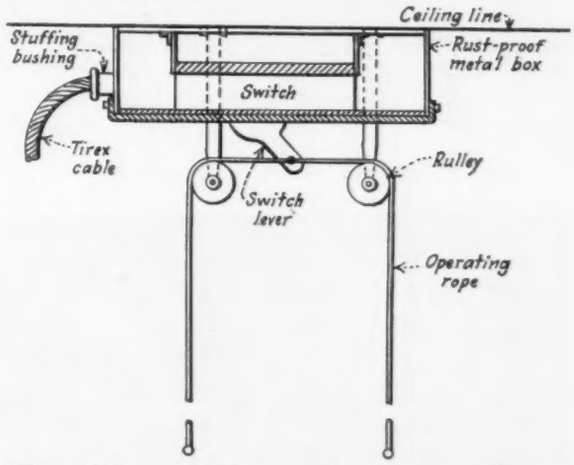
Motors in Fish-Freezing Plant Designed to Resist Moisture

In the motorized plant of the General Sea Foods Corporation at Gloucester, Mass., protection of motors and machinery against salt-water corrosion received much attention. Wiring with galvanized-iron conduit provided with air-tight moisture-proof fittings was generally adopted, and all metal work was treated inside and out with a high-grade corrosion-resistant covering. Inclosed motors were widely used, and in some cases starting switches serving semi-portable machines were mounted on the ceiling in rust-proof metal boxes, the motor connections being made with Tirex cable through a stuffing box, operation being by ropes to keep the switch box far above the floor and machine levels. Marine receptacles placed on the walls or columns facilitate the supply of energy to machines in various positions.

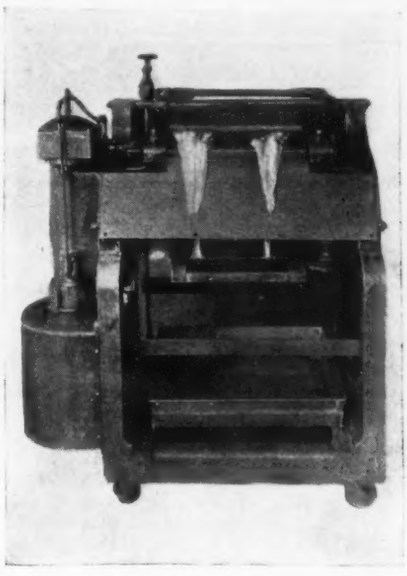
Isolation of individual motors against water damage has been provided for by inclosing them as shown in typical cases.

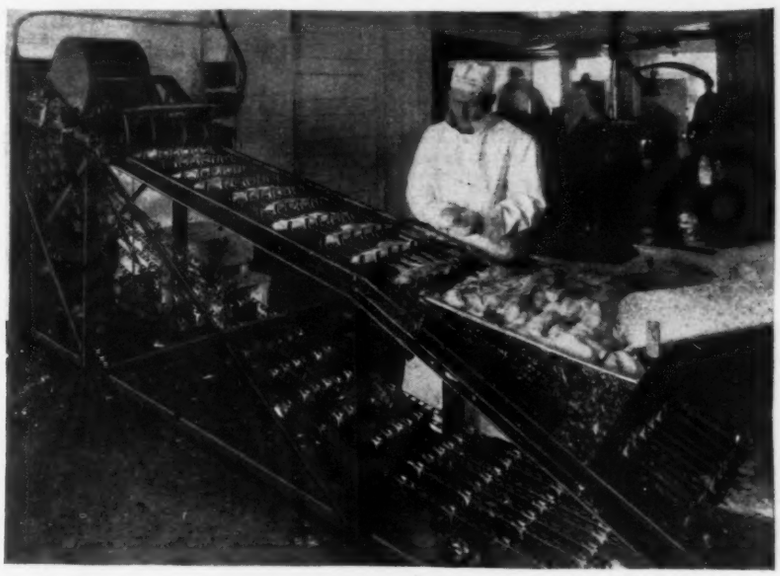


Water-tight switch box built of rust-proof metal and provided with ropes to clear damp working areas

Fish skinner with 2-hp. motor and inclosed drive

Mounted at side of machine to withstand severe conditions at varying locations.





Fillet cutter with monel-metal conveyor and rotary cutters

Driven by 1-hp totally inclosed motor through reduction gears. The motor is mounted to clear the travel of the fish toward the brine process in another room

Industrial Activity Rises 5 per Cent

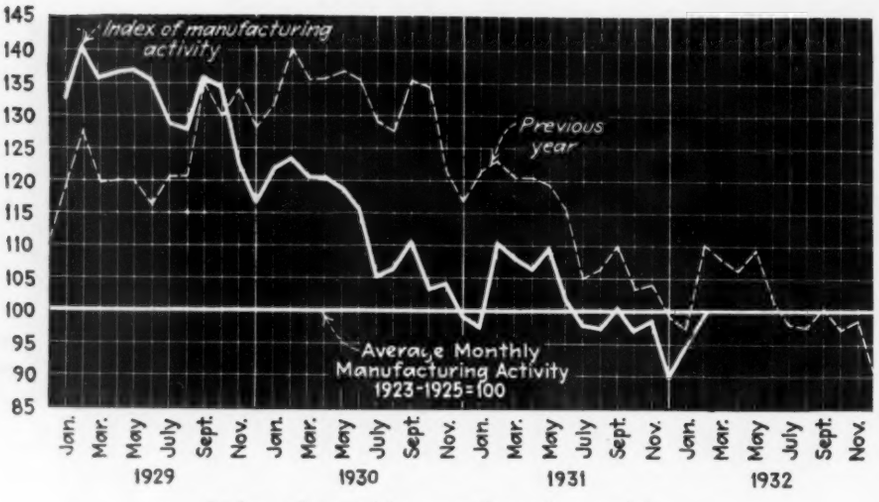
FEBRUARY usually brings a rise in manufacturing activity. This year the gain compared with January was 5 per cent. But that tells only a part of the story: The low point this winter came, as usual, in December and from that low point the rise in two successive monthly steps amounts to 10 per cent. It may or may not mark the beginning of a strong upward movement, but comparison with previous years shows the increase to have been greater than at the beginning of 1930 and fully as great as at the beginning of 1931 and even of 1929, when belief in a new economic era was still fashionable.

In the country as a whole the advance from December and January occurred in every industrial group here listed, without exception. In the manufacture of automobiles, parts and accessories the upward movement has continued uninterruptedly since last autumn. February brought a rise from January of 2 per cent and of 9 per cent from December.

So much has been written about this one industry that it is worth while to note what is going on in some of the others. The food industry, for example, continues above last year's level. The index for the leather industry, 77.0 in November, 79.2 in December, is now 90.6 and is 19 per cent higher than in February, 1931. The rise is observable in each of the geographical areas here recorded. The textile industry scored a gain of 10 per cent over January—a little less than last year, but enough to keep the average for the first two months at virtually the same level this year as last, and far above the low point in the summer of 1930.

To sum up, those industries that cater directly to the consumer either are well advanced from a minimum passed months ago or the demand for their product was so well sustained that no important sag occurred.

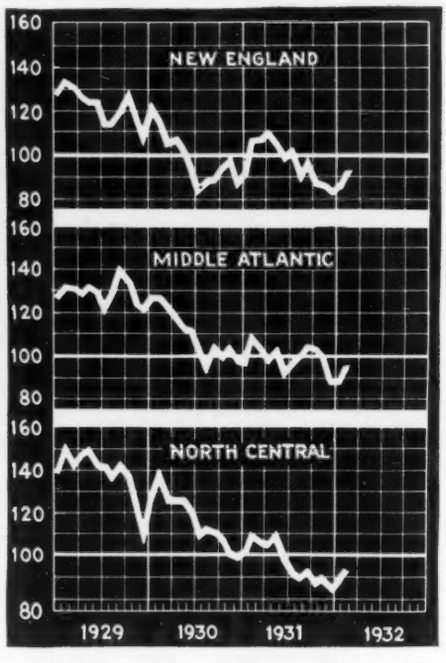
Meanwhile the upward trend, usual at this season, is again manifested, though not in general strongly, in those industries whose products go mainly into new construction or maintenance, such as iron and steel, machinery manufacture, lumber products, and the stone, clay and glass group, although all of these, except lumber, are still below last year's level.



Index of monthly manufacturing activity

Base: Average month 1923-1925 = 100.

(Corrected for number of working days, but not for seasonal variation). These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.



Industrial Groups	United States Feb., 1932	United States Jan., 1932	United States Dec., 1931	United States Feb., 1931	New England Feb., 1932	New England Jan., 1932	New England Dec., 1931	New England Feb., 1931	Middle Atlantic Feb., 1932	Middle Atlantic Jan., 1932	Middle Atlantic Dec., 1931	Middle Atlantic Feb., 1931	North Central Feb., 1932	North Central Jan., 1932	North Central Dec., 1931	North Central Feb., 1931
All industry	98.8	93.9	89.6*	110.3	93.0	87.2	84.5	105.5	95.4	89.6	89.7	108.0	93.1	89.6	82.9	109.0
Automobiles (including parts and accessories)	85.3	83.6	78.1	88.9	.....	.....	.....	.....	91.0	91.7	115.2	86.8	86.1	84.1	77.4	197.2
Chemical products (including oil refining)	137.1	134.3	118.2	146.6	147.6	149.5	128.5	185.8	151.1	145.6	128.0	146.0	131.0	117.3	102.8	149.6
Food products	129.5	127.2	124.8	122.0	.....	.....	.....	.....	101.5	95.8	102.0	92.4	115.0	110.8	115.8	132.8
Iron and steel	78.2	77.6	70.0	116.5	100.3	94.0	90.8	147.3	70.8	73.0	69.1	116.5	82.0	76.2	68.4	114.0
Metal working	74.8	72.7	70.9	112.3	95.7	91.3	93.2	117.0	79.0	75.5	63.5	91.7	69.5	68.7	69.4	91.6
Leather products	90.6	81.4*	79.2	76.1	82.8	72.8*	60.9	75.6	97.4	88.7	105.7	81.9	85.3	69.5	62.9	66.2
Forest products	86.8	81.9	74.1*	84.2	45.4	43.2	42.9	52.3	51.4	57.2	48.8	93.3	111.1	89.6	73.4	101.3
Paper and pulp	116.5	109.3	107.0	127.0	128.0	122.7	131.0	122.7	73.4	68.4	86.8	87.5	90.1	85.9	74.6	102.9
Rubber products	112.0	104.0	79.2	112.9	109.4	95.1	78.6	81.7	.....	.....	.....	.....	121.0	113.4	86.7	124.8
Shipbuilding	99.2	93.2	94.6	114.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stone, clay and glass	90.0	77.1	76.8	102.6	.....	.....	.....	.....	84.8	51.7	57.0	98.2	74.1	82.1	106.7	81.5
Textiles	96.8	87.8	89.8	99.3	76.8	65.6	68.3	82.5	113.1	102.0	102.8	108.0	112.7	105.5	109.2	131.2

*Revision.

READERS' FORUM

Contends Wrong Conclusions Drawn from Analysis of Florida Municipals

To the Editor of the ELECTRICAL WORLD:

A very interesting article appeared in the January 30, 1932, issue of the ELECTRICAL WORLD portending to show that in Florida municipal utilities increase the tax burden. Every one will agree with the statement in the article referred to that "during the years 1924, 1925 and 1926 Florida went through a most exaggerated period of expansion and growth which took on the proportions of a statewide boom." The first fallacy in the article is the assumption that municipalities were alone in overbuilding. It is undoubtedly true that private companies were just as much fooled. This is borne out by the rates which are being charged in such cities as Miami, Tampa, St. Petersburg and other places where private operation exists. It would have been well to compare the rates in the cities discussed with the rates charged in other Florida cities rather than with the average rates of large power companies as a whole.

The next wrong assumption is that 7 per cent interest should be charged against the value of the plant instead of 5 per cent against the actual indebtedness. It is very easy to say that interest should be charged on the entire value, but the fact remains that if the bond issue is less than the value and more interest is charged than is actually paid, the difference would be a saving to the city and it would actually have this money.

In the matter of taxes it is probable that the company would not have a power plant located in any of the cities discussed. Therefore, the city would receive taxes on the value of the distribution system only. However, in the following we have allowed taxes on the entire plant and system assuming 40 per cent of actual value for tax valuation, which is a usual practice. The probabilities are that the city would actually receive for taxes much less than this.

Depreciation is allowed as 5 per cent of the total value because the separation of water and light is not shown. This should be not over 5 per cent on light and not over 2 per cent on water. The following statements would give a much more nearly correct picture of the operation of these plants:

Plant	A	B	C	D	E	F
Gross earnings	$188,449	78,005	76,443	67,639	59,487	56,889
Interest 5 per cent	18,200	16,663	27,325	11,804	25,000	10,050
Depreciation 5 per cent	35,145	22,168	38,319	32,751	22,850	14,362
Taxes	4,512	2,136	8,750	7,336	4,575	2,875
Total costs	57,857	40,967	74,394	51,891	52,425	27,287
Net profit	$130,592	37,038	2,049	15,748	7,062	29,602

Thus, every plant is shown to be making a profit above interest, depreciation and taxes and some of them a very substantial one.

The average rate in these cities is compared with the average rate for the nation and with average rates of the Georgia Power Company and the Alabama Power Company. The figures include a large percentage of large power and a considerable percentage of intracompany business which is transferred frequently at an actual loss. This naturally brings the average rate down to a low figure. The average of the power companies above for residential uses do not take into consideration the amounts received for free service, street lighting and often water pumping; therefore, that comparison is worthless. It is probable that the average residential use in Florida does not exceed 30 kw.-hr. Below is given the average rate in several Florida cities up to an average use of 50 kw.-hr. per customer per month. Compare these figures with the average in the plants mentioned:

	Kw.-Hr. per Month			
	20	30	40	50
	Cents	Cents	Cents	Cents
Miami	11.4	10.8	10.5	10.3
Pensacola	10	8.3	7.5	7
St. Petersburg	10	9.3	8.5	8
Tampa	10	10	10	10
West Palm Beach	12	12	12	12

For the municipal plants the average residential rates are given as follows: Plant A, 6.309 cents; Plant B (not given); Plant C, 6.67 cents; Plant D, 9.83 cents; Plant E, 9.54 cents; Plant F, 8.10 cents.

The above rates for private companies are only for the largest cities in the state. The towns of the size of the municipal plants are probably paying much more.

It is thus shown that with rates considerably under those charged by the private companies these municipal plants are paying all expenses, including interest, depreciation and taxes, and are making a profit over that.

C. F. LAMBERT.

Burns & McDonnell Engineering Company,
Kansas City, Mo.

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Swiss Locomotives Do Not Accomplish the Impossible

To the Editor of the ELECTRICAL WORLD:

In connection with the article "New Swiss Locomotive Hauls 1,500-Ton Train," in the issue of February 27, 1932, I wish to state that the figure given for the maximum grades on the Gotthard line of the Swiss Federal Railways should read 2.7 per cent instead of 27 per cent. Most of your readers will, of course, have noticed this error and corrected it themselves, as it would be impossible for adhesion locomotives to run or haul trains over 27 per cent grades.

Brown Boveri & Co., Ltd.
Baden, Switzerland

PAUL R. SIDLER,
New York Representative.

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Corrections for "Vertical Radiator"

To the Editor of the ELECTRICAL WORLD:

I regret very much to have to point out some rather serious errors that occurred in my article which you published on page 360 of the ELECTRICAL WORLD of February 20.

The title that you used, namely, "Short-Wave Broadcast Towers," is in error, first because the article did not particularly concern the towers, but more specifically the insulation for these towers. Second, this is decidely not a short-wave construction, but one well in the center of the broadcast band, which has a wave length ranging from 545.1 m. to 199.9 m. Really, this should not be called a tower but a mast. The technical term that is

being applied to this type of construction is a "vertical radiator."

Under the picture on page 360 of the mast, you state that this is 18 ft. square at the base. Actually, it is 18 in. square, the cross-section at the point of attachment of the guys being 28 ft. square. Another error occurs on the title page, which may be numbered 337, in which you say "Insulator supports 34 tons." This insulator is designed to have a minimum breaking load of 340 tons and supports the mast of WABC, 665 ft. high. A mast 900 ft. in height would require an insulator of substantially greater strength. In fact, our design for a 900-ft. mast calls for an insulator having a minimum strength of 600 tons.

We feel that these are quite serious errors and would be extremely glaring to those more familiar with this installation and lack the interest of the real facts to other readers.

Lapp Insulator Company, Inc. RALPH L. JENNER.

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BOOK REVIEWS

Principles of Electrical Engineering

By G. C. Blalock. McGraw-Hill Book Company, New York. 498 pages, illustrated. Price, $4.

This is a text for non-electrical college students and deals with the fundamental principles of electrical engineering. Good illustrations, practical problems, concise statements and a list of laboratory experiments add to the useful value of the book. It deals with direct- and alternating-current machines and circuits and has chapters on meters, transmission and illumination. It omits any treatment of vacuum tubes and electronic phenomena and applications.

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Men, Money and Mergers

By George L. Hoxie. Macmillan Company. 225 pages, illustrated. Price, $2.50.

How far must beneficent capitalism go socialistic in order to compensate for the failure of man's economic and social development to keep astride his productive genius? Collectivism thrives on economic maladjustment, and when it finds environment unpropitious for mass progress it resorts to one-thing-at-a-time strategy. That the author interprets to be the significance of the present political incursions against the electrical industry.

Half the book is devoted to building the social and economic background of today's problem facing the utility. The economics of the industry, finance, merger, accounting and regulation are shown in relation to the profit incentive and progress as compared with stagnation under the complete suppression of individualism in a socialized state. Frank and unimpassioned, it alike shows the source of the plausibility of the socialist's concepts and the reasons for the perverse interpretation of the best motives of enlightened utility management. Its merit lies in the success with which the author steps out of his academic and utility (Southern California Edison) environment and assumes the rôle of a neutral observer concerned with social good.

Polyphase Induction Motors

By L. Lagron. Blackie and Son, Ltd., London. 218 pages, illustrated.

A rigid mathematical treatment of the polyphase-induction motor is presented, including the complete design of a motor. Tests, manufacture, application and variation in type of motors are also discussed. The book serves well as an advanced text.

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The Commutator Motor

By F. J. Teago. E. P. Dutton & Company, Inc., New York. 80 pages, illustrated. Price, $1.10.

Based upon the principle of energy transference, the author treats of the theory and performance of modern commutator type alternating-current motors. A compact and well-developed treatment is given.

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Principles of Direct Current Machines

By A. S. Langsdorf. McGraw-Hill Book Company, New York. 576 pages, illustrated, fourth edition. Price, $4.50.

This well and favorably known text has been revised and enlarged. It is distinguished for originality in graphical treatment, thoroughness of analysis and breadth of scope. The new edition will be very welcome to college teachers.

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Studies of German Manufacturing and Utility Corporations

Der Siemens-Konzern, 1931, 79 pages. Price, 4 reichsmarks.
Der A.E.G.—Konzern, 1931, 15 pages. Price, 2 reichsmarks.
6 Jahre Deutsche Reichsbahn-Gesellschaft, 18 pages. Price, 2 reichsmarks.
Die Reichselektrowerke, 75 pages. Price, 7 reichsmarks.
Published by R. & H. Hoppenstedt, Seydelstrasse 12-13, Berlin SW 19.

These four booklets are units in the "special library of German industry." The first three contain the kind of information that in the United States is supplied by financial works of reference, though usually in somewhat briefer form. This includes in each instance a condensed history of the company under consideration, statement of the scope of its activities, list of officers of the corporation, record of financial operations, balance sheets, description of subsidiaries and financial data concerning them, extent of the parent corporation's interest, nature of agreements or contracts with foreign affiliates.

Die Reichselektrowerke, by Dr. Ernst Heissmann, is essentially a case-study of government operation of public utilities as conducted in Germany. It is a defense against the charge that government operation is inefficient compared with private operation.

The monograph takes the form of an economic study of the whole problem of utility financing and operation, including the establishing of proper rates so that consumer groups (small and large users) are loaded with their due shares of capital charges. In the German case the adjustment of accounts during and after the financial collapse is necessarily considered. The conclusion is reached that the government has functioned effectively, economically and with vision for the future.

Men of the Industry

Ohio Electric Power Elects New Officers

William P. Moloney of Marion, Ohio, has been elected executive vice-president of the Ohio Electric Power Company and affiliated companies. L. C. Stang, also of Marion, has been elected vice-president in charge of operations and Elmer Shrider of Sidney has been elected vice-president in charge of the entire commercial department.

Mr. Moloney, who is also president of the Columbus, Delaware & Marion Electric Company and subsidiaries, is a graduate of Ohio State University and has been connected with the Columbus, Delaware & Marion Electric Company since its organization in 1917, being elected a director in 1920 and succeeding to the presidency in 1929. He not only knows every phase of utility operation but is a recognized legal authority on utility law, which is a very fine combination for leadership and guidance.

Mr. Stang entered the utility field in 1913 with the Des Moines Electric Company, working in several different departments. In 1916 he became associated with Sargent & Lundy in Chicago as engineer in large power plant design.

After the war he became connected with the Columbus, Delaware & Marion Electric Company as superintendent of the light and power department. In 1929 he was elected to the office of vice-president and general manager, which position he now holds in addition to his new appointment. Mr. Stang was graduated from Iowa State College in electrical engineering and followed this with special graduate training in the Westinghouse plant in Pittsburgh.

Mr. Shrider started in the utility field with the Albert Emanuel Company at Sidney in 1917 and continued with that organization until the Ohio Electric Power Company was formed in 1925, becoming vice-president and general manager of the latter company at that time. In 1927 he was made general manager of the Central States Edison Company with headquarters in Chicago., returning to Ohio in 1929 as vice-president and general manager of the Buckeye Light & Power Company, which position he still holds.

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GUGLIELMO MARCONI received on March 10 in Rome the John Scott award, made by the city of Philadelphia last year, for his invention of the wireless telegraph. John W. Garrett, United States Ambassador to Italy, made the presentation of the six-inch engraved bronze medal to the inventor at the United States embassy in the presence of a large group of notables. A check for $1,000, which accompanied the award, was given earlier.

HUDSON R. SEARING, assistant electrical engineer of the United Electric Light & Power Company, New York, has been appointed acting electrical engineer. Mr. Searing has been connected with the United organization since 1913, when he entered its employ as a tester. He was subsequently advanced to the position of cadet engineer in 1916, assistant engineer in 1919 and superintendent of the transmission and distribution department in 1921. Two years later he was appointed assistant electrical engineer.

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Woodrow and Knight Assume New Duties in Brooklyn

Harry R. Woodrow, who was recently elected vice-president of the Brooklyn Edison Company in charge of electrical operations, as announced in the February 27 issue of the ELECTRICAL WORLD, entered upon his public utility career in 1911 as assistant to the chief electrical engineer of the New York Edison Company, later being appointed assistant

H. R. Woodrow

chief electrical engineer. He relinquished the duties of this position to join the Stone & Webster organization in 1920 and after serving for two years as electrical engineer he became general engineer with the Westinghouse Electric & Manufacturing Company. It was in 1922 that he affiliated himself with the Brooklyn Edison Company as assistant electrical engineer and four years later was named electrical engineer, the position he occupied at the time of his recent election to a vice-presidency.

In the course of his career Mr. Woodrow has devoted himself with untiring effort to association work and the list of technical committees on which he has served is an impressive one. It includes the chairmanship of the protective devices committee of the American Institute of Electrical Engineers and of the power transmission and distribution committee, as well as membership on the executive committee of the standards committee and on the meetings and papers committee. He also has served as chairman of the electrical apparatus committee of the National Electric Light Association and as a member of the executive committee of the engineering section. He has served on the committee on electricity, distributing and use of the Association of Edison Illuminating Companies and on that association's committee on electric switching and switchgear.

G. L. Knight, new vice-president in charge of the company's mechanical operations, became identified with the Brooklyn Edison Company in 1905 as chief draftsman in charge of all design, mechanical and electrical, for generating and substations. In 1908 he was appointed designing engineer in charge of all design, mechanical, electrical and civil, and in 1923 he was named mechanical engineer.

G. L. Knight

Mr. Knight was graduated from Drexel Institute and received his early engineering experience with the Philadelphia Electric Company, New York Edison Company and the Walker Electric Company of Philadelphia. He is a fellow of the American Institute of Electrical Engineers and has been active in committee work in that association and in the National Electric Light Association. He is also a member of the American Society of Mechanical Engineers and of other technical associations.

C. S. Bagg New Vice-President of Montreal Utility

C. S. Bagg, recently appointed vice-president of the Montreal Light, Heat & Power Consolidated, as announced in the February 13 issue of the ELECTRICAL WORLD, has a background of 35 years' service in the employ of the company. Born at St. Cesaire, Que., Mr. Bagg was educated at Holy Cross College in that city and following graduation re-

moved to Montreal to join the staff of the Montreal Gas Company, one of the early components of the present metropolitan utility organization. For ten years he served in various capacities with the Montreal Gas Company and, after its incorporation in 1902, with the Montreal Light, Heat & Power Company. His progress in the several lines of work with which he was associated during that period is attested by his appointment, in 1907, to the position of assistant secretary-treasurer of the Montreal Light, Heat & Power Company.

In 1916 the present Montreal Light, Heat & Power Consolidated was formed and with its incorporation came the appointment of Mr. Bagg as secretary-treasurer. His multiple duties in this capacity continued to increase with the growth of Montreal and the consequent expansion of its public utility company and he gained an exceptional knowledge of company affairs during the twelve years in which he occupied the secretarial position. For this reason his appointment as general manager in 1929 was one for which he was eminently qualified and his appointment as vice-president is a well-earned recognition of his services. Mr. Bagg will continue to serve as general manager.

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H. R. PECKHAM, formerly assistant general superintendent of the San Diego Consolidated Gas & Electric Company, is now general superintendent. Mr. Peckham held the position of assistant general superintendent for eleven years. Following graduation from Princeton University he spent some time in the engineering department of the Pennsylvania Railroad in Indianapolis and then entered the engineering department of H. M. Byllesby & Company. In 1913 he transferred his interests to San Diego, becoming identified with the record department of the San Diego utility. After he was discharged from military service he joined the Tacoma Gas Company, but in 1921 returned to San Diego as assistant general superintendent.

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DR. VANNEVAR BUSH, of the electrical engineering department of the Massachusetts Institute of Technology, has been appointed vice-president of the institute and dean of engineering as well as a member of the corporation. Dr. Bush is known for his achievements in research and his contributions to technical education. He has especially interested himself in the design of scientific calculating instruments. In 1928 he was awarded the Levy medal of the Franklin Institute for the development of the product integraph. Recently he has won wide recognition for his design of an intricate calculating machine called the differential analyzer, which makes it possible to accomplish in a few hours engineering calculations that would take weeks and months, and with increased accuracy. He is also known for his contributions to the development of vacuum tubes and for his investigations in electric power transmission. Under his direction there has been built at the institute an instrument known as the network analyzer, on which a great power network, covering several states, may be accurately reproduced and its operating characteristics studied under the most satisfactory conditions. He has also carried on important studies of transients in machines and dielectric phenomena. Dr. Bush is a fellow of the American Institute of Electrical Engineers and of the American Academy of Arts and Sciences and a member of the Society for the Promotion of Engineering Education.

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OBITUARY

Frank G. Baum

Frank G. Baum, electrical engineer and inventor, died March 14 at Redding, Cal., in his sixty-second year. A pioneer in the hydro-electric and transmission developments of the Pacific Coast, Mr. Baum had been identified with the Pacific Gas & Electric Company and predecessor companies from 1898 to 1907. Since that date he had acted in the capacity of consulting engineer, at the same time engaging in an independent practice, specializing on hydro-electric developments. The conception and much of the engineering outline of the Pit River power development of the Pacific Gas & Electric Company are to be credited to Mr. Baum's foresight and sense of development possibilities. An early advocate of high-voltage transmission and superpower systems, he was the author of the "Atlas on U. S. A. Electric Power Industry," outlining a plan for nation-wide electric service. His work in developing insulators and regulation systems, the results of which he outlined in a paper, was recognized by the American Institute of Electrical Engineers, which awarded its yearly transmission prize for 1921 to him. He was the inventor of many electrical devices and the author of technical works which are in wide use as textbooks throughout the world.

Mr. Baum went to France and Germany as consultant for power corporations. Returning to this country, he established extensive laboratories in the mountains of northern California for the study of his profession.

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JOSEPH L. KLINE, president and manager of the Western Light & Fixture Company, Los Angeles, died in that city February 19. A native of Denver, Mr. Kline in his early youth removed to Seattle, where he remained until 1910 in various merchandising occupations. Then he went to Los Angeles, where he established an electrical supply house, which grew into a wholesale business of considerable size. Mr. Kline served as a member of the advisory committee of the California Electrical Bureau in 1926 and was chairman of the Pacific division, National Electrical Wholesalers' Association, for the same year.

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ERNEST WILSON, professor emeritus of electrical engineering at the University of London, who has just died, was a man of very brilliant intellect. Going to King's College, London, as demonstrator to John Hopkinson, whom he succeeded in the chair, Mr. Wilson taught in it for more than 40 years. He possessed an originality of mind which bore fruit in important contributions to the development of electrical engineering. He did much valuable pioneer work, particularly in the field of electric traction and in the early stages of radio. He also contributed to the knowledge of magnetic materials, and the first alternating-current commutator motor was his invention.

Trade News

Wagner Electric Net Income $348,748

For the year ended December 31, 1931, the Wagner Electric Corporation reported net income after expenses, depreciation, federal taxes and other charges amounting to $348,748, equal after preferred dividends to 67 cents a share on 391,389 common shares, compared with $813,362, or $1.85 a common share, in the previous year.

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E. H. Bell has been appointed sales manager for the Jeffries Transformer Company, Los Angeles. Mr. Bell was formerly sales engineer for the General Cable Corporation, and prior to that time was senior partner of Bell & Slimmon, sales engineers.

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Worthington Pump & Machinery Corporation reports for the year ended December 31, 1931, net loss after depreciation and taxes of $660,158, against net profit of $2,056,093, equivalent, after dividend requirements on 6 and 7 per cent preferred stock, to $8.23 a share on 126,921 shares, in 1930.

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Directors of the Sangamo Electric Company deferred action on the quarterly dividend of 25 cents on the common stock due for payment April 1 until June.

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Donald M. Simmons, chief consulting engineer of the General Cable Corporation, New York, was re-elected president of the Insulated Power Cable Engineers' Association at a recent meeting. The other officers re-elected were T. F. Peterson, cable engineer of the American Steel & Wire Company, vice-president, and Dr. R. J. Wiseman, chief engineer of the Okonite-Callender Company, secretary and treasurer.

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Sales of the Electric Storage Battery Company and the Willard Storage Battery Company for the year ended December 31, 1931, totaled $24,895,113, against gross sales in 1930 of $36,889,454. Net income was $2,770,457, against $6,289,300 for the previous year.

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Western Pipe & Steel Company of California and Blaw-Knox Company of Pittsburgh have announced the formation of a new subsidiary, Blaw-Knox & Western Pipe Corporation, to handle the sales of the Blaw-Knox Company products on the Pacific Coast. Howard C. Tallerday, president of the Western Pipe & Steel Company, is president of the organization.

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Railway & Industrial Engineering Company has just issued a bulletin on automatic air circuit breakers.

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Electromaster, Inc., announces the appointment of Norge Nestor Company, Inc., of Jacksonville, as "Electrochef" distributor for Florida and southern Georgia.

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George Belsey Company, Ltd., since 1927 southern California distributor for General Electric refrigerators, recently was given the General Electric automatic range franchise covering the same territory. The George Belsey Company, Ltd., operates its own retail stores in several cities.

Wagner Electric Corporation of St. Louis has issued a new 22-page bulletin on squirrel-cage motors called bulletin 174. It describes several types of squirrel-cage motors, giving application tables, speed-torque curves and complete construction details.

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The annual report of the Link Belt Company for 1931 shows net profit after charges, taxes, depreciation of $638,974, which is equivalent to 54 cents a share on common stock, as against $2,310,332, or $2.89 a share, in 1930.

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The Thermogray Company of Jefferson, Iowa, manufacturer of storage type electric water heaters, announces that Karl R. McClung, formerly with the Northern States Power Company at Minneapolis, joined its organization to take charge of sales and advertising as of March 1, 1932. Mr. McClung was for two years chairman of the water heating committee of the North Central Electric Association and brings to his new position a well-grounded understanding of the development problem of this class of electric service.

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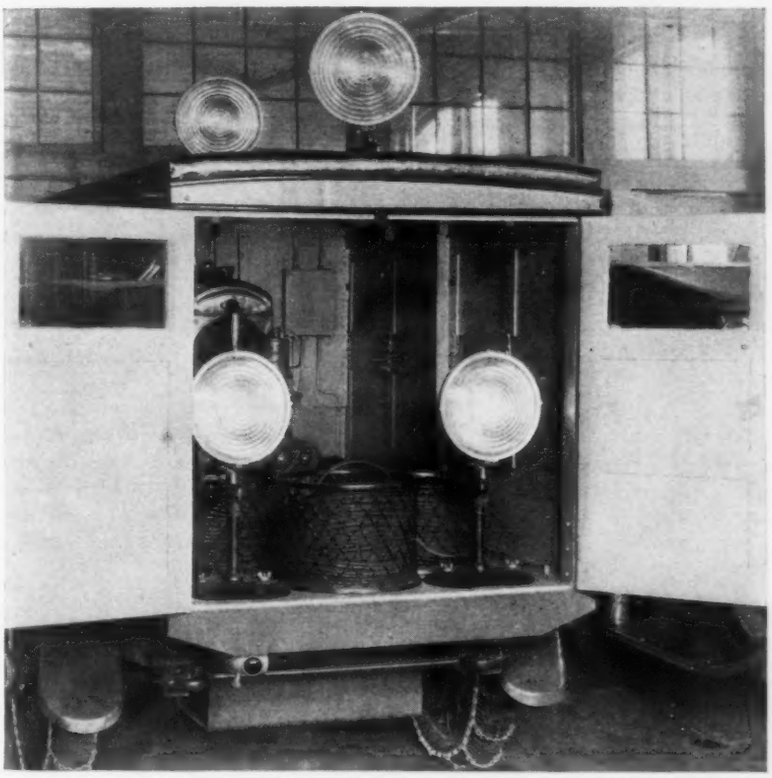
FLOODLIGHTING TRUCK AIDS FIREMEN



Hazards at night fires are, according to Fire Chief Joseph N. Sullivan of the Utica (N. Y.) department, definitely reduced by this floodlighting service truck. Fire, water and abrasion appear to have few terrors for the cables used to link the portable lights with the truck-mounted 2-kw. gas-engine-driven generator. Two No. 16 500-ft. Rome super-service two-conductor cables with extra 500-ft. extensions are used. These are a product of the General Cable Corporation.

New Equipment Available

Load-Ratio Control for Small Transformers

Extension of the benefits of load-ratio control to power transformers of the smallest capacity is now possible, it is announced by the General Electric Company. The new equipment has, it is said, been economically applied to transformers rated between 500 and 2,000 kva. Similar in principle to the devices used for large G.E. transformers, a separate tap for each specified ratio is utilized; an essential difference, is however, a motor-wound-spring driving mechanism and twin ratio adjusters which combine the function of ratio adjusters for changing the transformer tap connections with that of contactors for opening and closing the circuit.

In the driving mechanism a motor winds a heavy helical spring which, when released, snaps the ratio adjuster to the next position. The spring is reversible, thus permitting a time delay to prevent operation because of voltage fluctuations of short duration.

The power required to drive the mechanism is extremely small because a very large gear reduction is used between the motor and the spring. A 1/100-hp. capacitor motor is operated from a single-phase, 60-cycle, 110-volt supply. A revolving field is obtained by use of a capacitor so that neither a commutator nor a centrifugal switch device is required, thus providing the mechanical simplicity of a polyphase squirrel-cage motor. A double field makes the motor reversible.

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INCORPORATION OF A VACUUM DUST-DISPOSAL FEATURE in the portable disk sand grinder of the Porter-Cable Hutchinson Corporation, Syracuse, N. Y., has been accomplished without detracting from the portable features or ease of use of this appliance. Marked increase in suitability of this sort of equipment for such production work as preparing automobile bodies for painting, grinding down welds, smoothing castings or finishing metal surfaces is said to have been realized.

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A SERIES OF UNILETS designed for use in hazardous locations according to the requirements of the Underwriters' Laboratories has been announced by the Appleton Electric Company, Chicago. The unilet body is made of malleable iron and the cover is cast brass. All metal-to-metal joints are machined and no gaskets are required. This construction classifies the "Gru" and the "Gruy" series of unilets as explosion-resisting fittings, making them acceptable for installation in class 1 and class 2 locations. These unilets can be furnished complete with either rotary or toggle switches. The switches are operated by means of a shaft extending through the accurately machined bearing surfaces. No stuffing boxes or gaskets are required.

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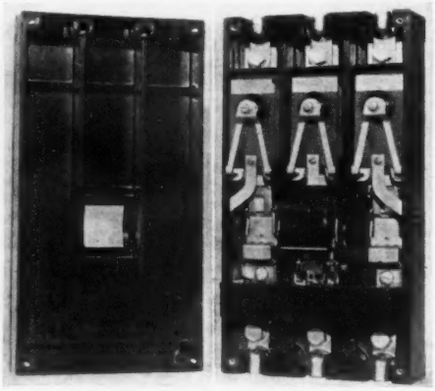
"Deïon" Principle Extended to New Low-Voltage Line

For the field now covered by open knife switches, air circuit breakers and fuses in various combinations the Westinghouse Electric & Manufacturing Company has announced the development of a new line of low-voltage cir-



cuit breakers for industrial plant and commercial building application. The Deïon principle previously developed for high-voltage breakers is the foundation of the new design. In conjunction with thermal time-delay and instantaneous trip features it not only offers the protection now afforded by fuses but compares most favorably in cost and space requirements with the prevailing combinations of carbon circuit breakers and fuses as used at centers of distribution in the larger buildings, small factories, etc.

Ultimately the line will extend from 15 to 600 amp. on voltages up to 600 volts for a.c. and 250 volts for d.c., each founded on protection of circuits of the standard wire sizes. The 225-amp. frame carries ratings of 50, 70, 90, 100, 125, 150, 175 and 225 amp., the breaker mechanism being identical throughout but the trip units being varied to provide the assigned ratings. On the 600-volt a.c. and 250-volt d.c. breaker the Deïon chamber has the "arc spinner" design with cold cathode. The lighter duty 250-volt a.c. and 125-volt d.c. ratings employ the "arc splitter" form of Deïon suppressor. The interrupting capacity of the 50 to 225-amp. AB breaker is 10,000 amp. maximum.

The extinction of the 10,000-amp., 600-volt arc is so abrupt and well controlled that, as shown in recent tests, it does not even singe cotton batting wrapped around the breaker case. The trip units have two entirely separate tripping functions. The time-delay to simulate fuse action is obtained through a bimetal unit. The instantaneous trip can be calibrated to require an inrush of eight to ten times breaker rating before tripping occurs. The bimetal will trip in eleven seconds on 600 per cent rating, but will hold 22 minutes on 150 per cent of rating. All breakers are mechanically trip-free from the handle, which serves as the position indicator. Quick make and quick break are provided. Main contacts are silver to silver protected by silver-tungsten arcing tips. These features adapt the breaker to such repetitive functioning as in connection with spot-welding machines, etc.

Valuable space can be conserved in switchboard designs employing these breakers because they require only about 70 per cent as much mounting space as carbon breakers. Multipole designs are built in exact multiples of the single-pole unit for each rating. Depths are approximately 4 and 5 in. and lengths 15½ and 21½ in. respectively for 225 and 600-amp. breakers.

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Wire Insulating Speeded and Improved

Said to mark a notable advance in wire-insulating practice a ten-unit, 8-ton machine which offers the advantages of high-speed production, decreased floor space, great flexibility and unusually close control of insulation space factor has been developed by the Elevator Supplies Company, Inc., for one of the large electrical manufacturers.

Individual two-speed motor drive for each spindle eliminates the use of clutches with their inherent troubles. The flyers operate at a speed of either 4,500 or 6,000 r.p.m. and will handle paper, cotton, silk or cellophane on No. 18 to No. 26 copper wire, at a maximum output with paper of 200 ft. per minute. Automatic stops protect production. Push-button control is used. Floor-area saving is almost two to one as compared with previous facilities. So efficiently is the laying done that two layers of insulation suffice where three were formally needed. While not in quantity production, this equipment can be supplied for similar purposes elsewhere with variations.